IBAAS-CHALIECO 2013

INTERNATIONAL SYMPOSIUM

Present Status and Future Prospects of
Bauxite - Alumina - Aluminium Industry of the World

Special Reference to **CHINA**

SOUVENIR

NOVEMBER 28-30, 2013
VENUE – NANNING, GUANGXI, CHINA

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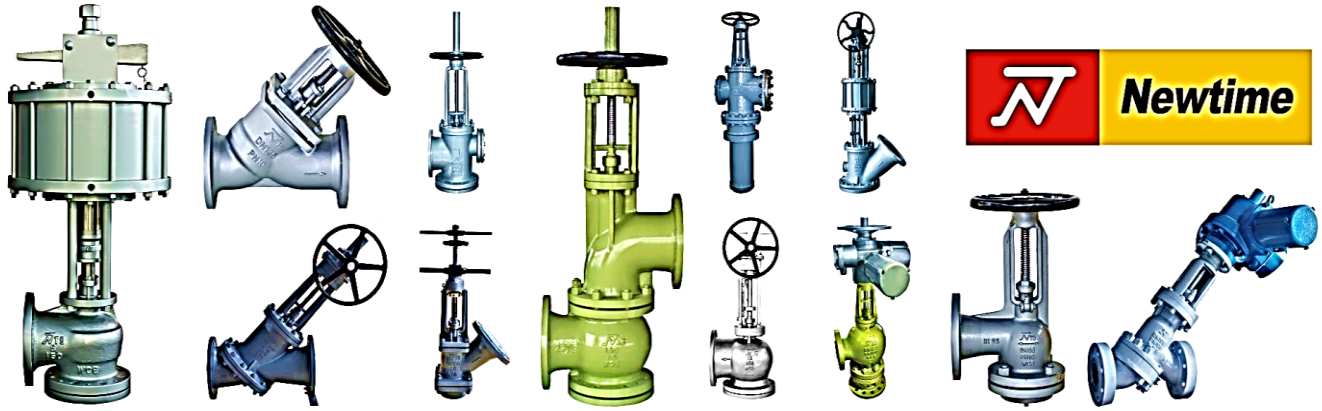
HANGZHOU NEW TIME VALVE CO., LTD

COMPANY BRIEF



Though established in 2001, New Time's technical team have more than 35 years of experience in the production of slurry valves for the alumina industry, and accomplished the Chinese government assignment of nationalization of slurry valves for the alumina production process to have put an end to importing them. Accordingly New Time has set up and refreshed technological standard in this line.

Domestic Market:

Of all 40 domestic companies [including Chalco(Aluminium Corporation of China Limited) & its branches], New Time supplies 38, covering 95% of home market, like Henan, Shangdong, Guizhou, Pingguo, Zhongzhou Branches …and other large or medium scale of private companies, such as Senze in Shanxi, Kaiman, East Hope, Bosai, Weiqiao in Shandong, Chiping Xinfa in Shangdong etc. They have been New Time’ s long term cooperative parterns.

International Market:

With steady increasing capability as well as domestic success, New Time has been aiming at much wider world market since 2008. Up to now we have supplied 4638 slurry & general valves of different type, size and rating to an Indian company, Vedanta Aluminium Limited.For Lam Dong Bauxite-Aluminum Complex Project (Vietnam), we have shipped 310 valves including crucial Long Stem Discharge Valves. New Time is supplying 108 valves for Tan Rai alumina plant too.Also we’ ve supplied 237 valve to Alcan Rio Tinto Gardanne (France) alumina plant, and Greece Aluminium Ltd, Alunorte Aluminium Ltd. (Brasil), Aughinish -RUSAL(Ireland), Jajarm Alumina Plant -Iran Alumina Company as well.And we are also contacting with other alumina projects worldwide.

Product Range:

We design and produce 8 varieties of valves, with more than 800 specifications according to international standards such as ASTM, PED, ASME/ANSI,API, JIS, BS, DIN and national standards like GB, JB, HG and DL, etc. Customization is available too. The nominal diameter varies from DN15 to DN1500 （1/2 " to 60"）， the nominal pressure differs within 1.6 Mpa to 42.5 Mpa (class150 lbs to 2500 lbs), and operating temperature from -196℃ to 750℃.

Quality System:

The company has been well managed with ISO9001:2000. CE certificate and API have been with New Time too.

Address : No.1888, Huannan Road, Linglong Industrial Zone,
Lin'an City, Hangzhou, Zhejiang, China
Tel: 86-571-61071807 Fax: 86-571-61071802 Http://newtimevalve.com
Email: newtimevalve@foxmail.com

企业简介
Company Introduction

山东景津环保设备有限公司（原景津压滤机集团有限公司）是全球规格最全、产量最大的压滤机专业制造商、销售商和服务商，负责全国分离机械标准起草和修订工作，压滤机及滤板国家标准的主起草人，国家火炬计划重点高新技术企业。压滤机类产品中，唯一被国家工商总局认定的“中国驰名商标”；“景津”商标取得了马德里国际商标注册保护。董事长姜桂廷被评为“中国十大杰出企业家”。

景津自1988年进入压滤机行业，就坚持以细化、创新、速度为发展理念。景津一直致力于品牌的建设，坚信品牌不是有哪个机构评选出来的，而是由顾客用货币当选票选出来的。自2004年已连续九年全球产销量第一，拥有自主知识产权的产品，远销欧盟、美国、俄罗斯联邦、日本、巴西、南非、澳大利亚等123个国家和地区，成为世界一线品牌。景津在过国内划分为17个销售区域，有500多名专业的销售、技术服务人员，保证了12小时内到达用户现场；在国外有45家专业代理商和服务商，能够满足不同地域和不同行业客户的需求。

景津一直致力于员工工作环境的改善。我们不但要为员工提供一个岗位，获得理想的薪酬，更要让他们身心受益，营造一个舒适的工作氛围，真正感觉到在景津工作提高了生活品质。景津还成立了“爱的家园基金”，帮助景津生活困难和有残疾儿童的职工家庭。景津还经常开展各种文体活动和比赛，展示员工的精神风貌，增强企业的凝聚力。

您的笑容就是我们的承诺。景津压滤机为您考虑一切……，景津永远是您最好的朋友！

Shandong Jingjin Environmental Protection Equipment Co.,ltd（with former name Jingjin filter press group co.,ltd） is the professional manufacturer, seller and service provider of filter press with the most complete specification and the biggest output in the world. It's responsible for the revision and drafting of the national separation machinery standard. It's also the main draftsman of filter presses and filter plates national standard and key high-tech enterprise of National Torch Plan. In the filter press industry, it's the unique one to be affirmed "the well-known brand of China" by national industrial and commercial bureau. "Jingjin" brand has applied for Madrid international registration protection. The president Mr. Jiang Guiting is honored "one of the top ten famous enterprisers".

Since Jingjin entered the filter press industry in the year 1988, it insists on the development concept of detailing, rapidity and innovation. Jingjin has always being committed to the brand construction, and we firmly believe that the brand was not appraised by any agency, but voted out by customers using money as ballet tickets. It's placed the international sales No.1 position for eight successive years since the year 2004. The products with proprietary intellectual property rights have exported to 123 countries and areas such as EU, the U.S., Russia, Japan, Brazil, South Africa and Australia etc. Jingjin brand has become a top international brand. Jingjin has 17 sales territories in China, and with more than 500 after-sales service personal in different industries, ensure to arrive on the scene within 12 hours. We have more than 45 professional agents in foreign countries, formed perfect distribution network and professional service team.

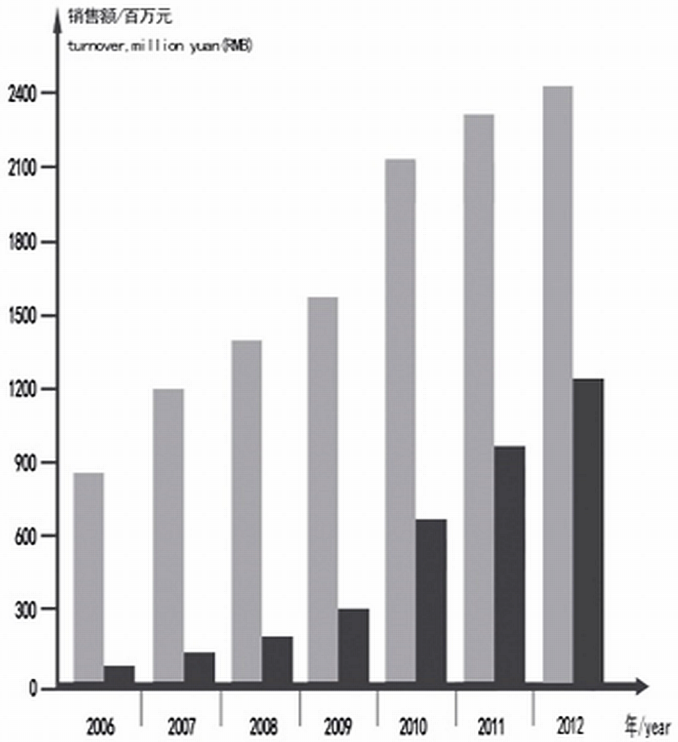
Jingjin ensures the quality upgrades continually, so as to satisfy the requirements of different customers. Except for standard parts and electrical components, all the fittings are produced by ourselves. Jingjin group not only improves the quality of products, innovate science and technology internally, but also improves market service externally so as to suitable for various customers. Jingjin provides perfect filtering techniques and services for all the solid-liquid separation customers in the world.

Your smile is our commitment. Jingjin filter press considers all for you……, Jingjin is your best friend forever!

景津压滤机总装公司(占地72万平米)
JINGJIN FILTER PRESS FINAL ASSEMBLY CO.,LTD.

景津滤板公司(占地4.7万平米)
JINGJIN FILTER PLATE CO.,LTD.

景津压滤机总装车间
Jingjin Filter Press General Assembly Workshop



景津连年跨越发展，为服务于全球固液分离行业打下基础。

JINGJIN has been developing rapidly in recent years which makes a solid foundation for the global solid-liquid separation industries

景津集团总部(占地7万平方米)
HEADQUARTERS OF JINGJIN GROUP

AN INTERNATIONAL SYMPOSIUM ON

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WITH SPECIAL REFERENCE TO

CHINA

One of the biggest events on bauxite, alumina, aluminium and aluminium fabrication in Asia!

A unique opportunity to learn more about the spectacular developments in the alumina and aluminium industry of the world with special insight into China, directly from the Industry Experts.

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NOVEMBER 28-30, 2013

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IBAAS-CHALIECO 2013

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Welcome Note

On behalf of the organizing committee, it is our pleasure to welcome you to the IBAAS-CHALIECO-ANTAIKE Symposium on **'Present Status and Future Prospects of Bauxite- Alumina-Aluminium Industry of the World, with Special Reference to China'** being held in Nanning, Guangxi, China from November 28 to 30, 2013. China, being a leader in production of bauxite, alumina and aluminium in the world, the conference will provide latest direction of aluminium industry, R&D activities, market trends and also provide great opportunities for networking with Asian Aluminium Industry players. The symposium organizing committee is formulating a world class program focusing on key topics and issues in the bauxite, alumina, primary aluminium and aluminum downstream industry of the world with special reference to China.

The aluminium industry structure is rapidly changing and production centres are shifting to developing, high growth potential countries of the world. Keeping in view and the increasing role of China in production of all types of bauxite, alumina & aluminium, second IBAAS event is being organized in that country. In the present depressed market, it is necessary to upgrade technology, improve alumina & aluminium production technology and diversify production to value added products. Taking all these facts into account, the Symposium has been planned with the following objectives:

- To review the promising research and development activities aimed at improving production and productivity in the existing bauxite mines, alumina refinery and aluminium plants.
- To highlight the proposed Greenfield activities of aluminium industry in the world with special reference to Asian countries.
- Latest technological developments in the field of bauxite beneficiation, alumina production, aluminium smelting and aluminium products.
- Import and export potentials of bauxite, alumina and aluminium in China and other Asian countries
- Latest technological developments in aluminum downstream industry.
- Market and price trend of bauxite, alumina and aluminium and their products.

We welcome you to this symposium and are confident that your will all benefit from the authors, experts and industry professionals who have submitted papers and will share their technical presentations in this Conference.

Best Regards

Organizing Committee of IBAAS-CHALIECO-ANTAIKE 2013

IBAAS-CHALIECO-ANTAIKE 2013 Symposium
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- Metrohm China Limited, China
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- Zibal Exim, India

IBAAS-CHALIECO-ANTAIKE 2013 Symposium

Participating Companies

International Bauxite, Alumina & Aluminium Society

IBAAS

Company Profile

The aluminium industry structure is rapidly changing and production centres are shifting to developing, high growth potential countries of the world. Keeping the present development pace and growing importance of Asian countries, International Bauxite, Alumina & Aluminium Society (IBAAS) is set up in this part of the world by professionals active in various fields of aluminium industry. The initial activities will be focused in the Asian region with special attention to India, China, Vietnam, Indonesia, Saudi Arabia and UAE. The founders of this society have vast experience in organizing similar conferences on bauxite, alumina and aluminium in India and China. The objectives of IBAAS are as follows:

- Provide platform for aluminium industry professionals to interact and work together for the common goal and development of the industry
- Organise annual and bi-annual workshop, seminar and conferences in association with primary aluminium producers and/or R&D centres
- Represent primary aluminium industry as an independent organisation
- Promote latest technology and advertise products and equipment.
- Publish, papers, monographs and books to highlight latest achievements in the field
- Facilitate technology transfer and compile a list of experts available in the field.

The development in non-metallurgical applications and uses of bauxite and alumina are also rapidly changing and in the recent past several small to medium sized independent industries have come up in India and China to produce value added items. IBAAS will actively address various issues associated with the development of this industry and disseminate latest R&D activities in this field.

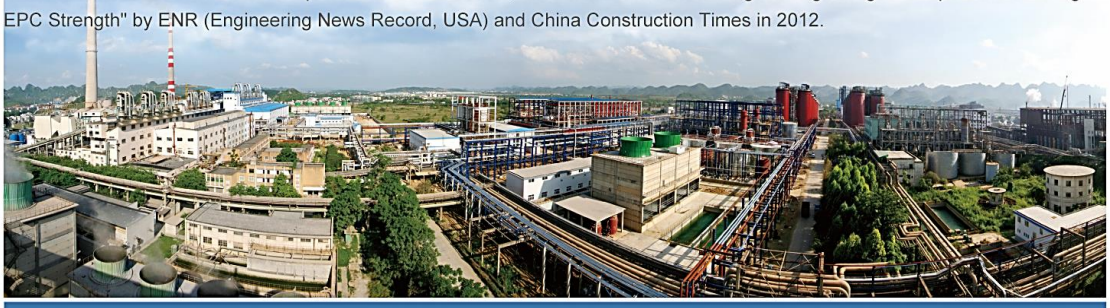
CHINA Aluminum International Engineering Corporation Limited

CHINA ALUMINUM INTERNATIONAL ENGINEERING CORPORATION LIMITED (CHALIECO) was registered in the People's Republic of China on December 16th, 2003. Being reorganized into a joint-stock company on June 30th, 2011, it was sucessfully listed on the main board of Stock Exchange of Hong Kong Limited on July 6th, 2012 (stock code: 2068). As a high-tech company integrating R&D, construction, surveying and mapping, equipment manufacturing, CHALIECO mainly counducts engineering design and consultation, project construction, EPC contracting and equipment manufacturing. The controlling shareholder of CHALIECO is Aluminum Corporation of China (CHINALCO), one of Fortune Global 500.

CHALIECO consists of four of the first eight large-scale design and research institutes established in 1960s in Chinese non-ferrous metals industry, one survey and design institute and five large-scale construction enterprises. CHALIECO was extensively involved in the planning, design, research and construction of various industries including metallurgy, transportation, electric power, petroleum, chemical industry, building materials, military industry etc., creating several “First in China" and setting a number of industrial records. CHALIECO enjoys high reputation due to the notable contribution it has made, which positively promote the development of national economy and social benefits, particularly, the growth and technical progress of non- ferrous metals industry in China.

CHALIECO persists in the implementation of technology development and globalization strategies to diversify its business scope by making use of both domestic and overseas markets and resources. While devoting itself to the establishment of international top rank engineering company, CHALIECO has become a leading technology, engineering service and equipment supplier in the non-ferrous metals industry in China, capable of providing integrated solutions throughout various stages of the non-ferrous metals industrial chain and the related fields

CHALIECO vigorously takes part in the development and construction of infrastructure, ecological & environmental engineering and public utilities, making significant contribution to the building of a resource-saving and environment-friendly society. As a result, CHALIECO was honored as an AAA grade company in credit rating of non-ferrous metals industry and "AAA Credible Organization" in China international trade and cooperation field. Moreover, it was also rated as an "Engineering Design Enterprise with Strongest EPC Strength" by ENR (Engineering News Record, USA) and China Construction Times in 2012.



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Since being established in 1992, Antaike has achieved a reputation for its authoritative, strategic, and in-depth analysis of the Chinese metals industries and markets. It also provides news, trade and production data, prices and forecast.

Working under China Nonferrous Metals Industry Association (CNIA) and directly overseen by the Information Center of China National Nonferrous Metals Industry, Antaike has become a key center for information collection and delivery within the country and across the world.

Antaike has a team of over 150 highly skilled employees, including more than 40 senior metals analysts that all have been engaged in the metals and mining industry for over a decade and enjoy sound reputation worldwide. It is capable of undertaking customized consulting assignments to deliver high quality and specialized advice and business intelligence.

Antaike has built up good relationship with thousands of Chinese metals miners, smelters, refineries, fabricators, consumers, traders, and Chinese government departments. At the same time, it has been working with a large number of international metals and mining corporations, associated organizations and research institutes. Number of its total clients, including both Chinese and foreigners, has exceeded 10,000.

Antaike's metal events attract more and more Chinese and foreign delegates in the recent years and become the biggest and most influential gatherings in China and even the world, especially for such specific metals as copper, aluminum, lead and zinc, nickel and cobalt, gold and silver, indium, etc.

Antaike's philosophy is to supply the best service to our clients and to let our information to create business value.

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www.antaike.com

ABSTRACTS

CHALIECO, ANTAIKE & IBAAS

SECTION I

BAUXITE & ALUMINA

The characterization of Bauxite for Refractory Application

P. Sengupta
SKG Refractories Ltd
Nagpur, India

Abstract

Bauxite finds wide use as a raw material in Refractory manufacturing industry and is considered as one of the most important raw material for Refractory industry, because of its certain unique characteristics. The requirement of the properties of Bauxite, for converting it into Alumina and subsequent use for Aluminium extraction and other applications, is quite different from its use as a Refractory raw material. The availability of the Refractory grade Bauxite is much less than that of the metallurgical grade of Bauxite and need to be preserved carefully. This paper discusses the special properties required for the Refractory grade Bauxites and their characterization to identify the correct quality of Bauxite as Refractory raw material.

Geology, geomorphology and characteristics of Gujarat Bauxite and prospects of its development

D.U.Vyas,
GMDC, Ahmedabad
and
A.K. Nandi,
Sr. Geological Consultant, Mineral Information & Development Centre,
Nagpur, India

Abstract

Gujarat bauxite deposits have unique position in India thanks to presence of high grade white bauxite and large resources of metallurgical and cement grade ore. The low lying bauxite plateaus (50 to 100 meters above mean sea level) are mainly spread in Jamnagar, Kutch, Junagarh, Amreli, Bhavnagar, Sabarkantha, Surat, Valsad and Ahmedabad districts. These lateritic bauxite deposits have unique geomorphic features and have undergone de-ferrification and alteration under waterlogged conditions. The ore characteristics also widely vary with the presence of boehmite, diaspore and calcite apart from usual bauxite minerals. The bauxite resources were estimated as 97 million tons in the past based on high cut-off values of alumina and silica. This may substantially increase as a result of changing cut off and incorporating large unexplored areas. Gujarat bauxite offers vast potential for the developments of non-metallurgical industries, value added bauxite/alumina products, feed to existing refineries and export.

IDENTIFICATION OF ALUMINOUS LATERITE OCCURRENCES WITH HIGH RESOLUTION ASTER SATELLITE IMAGERIES

S. Karunakar Rao and A. K. Das
DATACODE, K- 26, 2nd Floor Kinkhede Layout
Opp L.I.T. Bharat Nagar, Nagpur 440 033, India
and
Ashok Nandi
Mineral Information & Development Centre, Nagpur, India

Abstract

Integrated remote sensing (RS) and geographical information system (GIS) has been key to delineating mineral deposits worldwide. In India there are several aluminous laterite occurrences in the country at low level areas of Eastern Ghats, Central India as well in Western Ghats and Gujarat, which can be identified with the help of satellite imageries. With the advent of accurate satellite imageries, the integration of geographical information systems (GIS) and laterite / bauxite geological knowledge offers a relatively fast, accurate identification of potential laterite development.

In our present study, ASTER (30m resolution) satellite imageries are used to identify the laterite bauxite plateaus by method of analogy with the known deposits. These ASTER imageries led us to develop maps of elevation contour, slope aspect, topo shapes and also classify the slope for the best development of aluminous laterites. Based on these studies, highly probable and possible aluminous laterite deposits were identified in one of Indian states and further field checks provided confirmation of some of the good laterite occurrences.

THE FUTURE OF CERAMIC PROPPANTS IN INDIA

A.K. Dasgupta
HALLMARK MINERALS (I) PVT. LTD.,
A-J Tower, 176 Dahanukar Colony, Kothrud, Pune.
and
Ashok Nandi
Mineral Information & Development Centre, Nagpur, India

Abstract

A small pilot-cum-commercial sintered bauxite (proppant) plant was set up in 2004 in Pune, India and started the production of high strength proppants in 2005. To produce different qualities of Ceramic Proppant, raw bauxite are sourced from three different mines in central India, clay is also mixed wherever required and blend to get the desired raw mix proportion. As a first step defined quality of raw bauxite feed is calcined near the bauxite sources in central India, their physical and chemical properties are thoroughly checked and after quality certification same is considered as raw material for proppant plant unit at Ranjangaon near Pune (About 200 km from Mumbai). Calcined

bauxite is micronized, palletized, screened and sintered in this unit. The quality of sintered bauxite is checked in the on-site laboratory based on the recommended practices of API RP60 Procedures.
The small quantity of sintered bauxite produced in Pune plant is well comparable to high strength proppants of Saint Gobain, Carbo-ceramic of US and also Curimbaba, Brazil. This pilot plant has also produced Intermediate strength proppants by changing the raw mix and product was found acceptable in the world market. Efforts are being made to set up a large sintered bauxite plant in India for commercial production of proppants for hydro-fracturing of non-productive oil and gas wells and future shale gas production.

BAUXITE DEPOSIT AND MINING IN JHARKHAND

Brijesh Kumar Jha
Hindalco Industries Limited
Muri, Jharkhand

Abstract

Bauxite is an aluminium ore and is the main source of aluminium. Bauxite was named after the village Les Baux in southern France, where it was first recognised as containing aluminium and named by the French geologist Pierre Berthier in 1821. Bauxite is basically an aluminous rock containing hydrated aluminium oxide as the main constituent and iron oxide, silica and titania in varying proportions. Hydrated aluminium oxides present in the bauxite ore are diaspore and boehmite, $Al_2O_3.H_2O$ (Al_2O_3- 85%; Al-45%); and gibbsite, $Al_2O_3.3H_2O$ (Al_2O_3- 65.4%; Al- 34.6%). The iron oxide in bauxite ore is present as hematite or goethite, silica as clay and free quartz, and TiO_2 as leucoxene or rutile. Bauxite is an essential ore of aluminium which is one of the most important nonferrous metals used in the modern industry. It is also an essential ore for refractory and chemical industries. The country has abundant resources of bauxite which can meet both domestic and export demands.
Major deposits are in East Coast falling in Visakhapatnam and East Godavari districts of Andhra Pradesh and Phulbani, Sundergarh, Bolangir, Sambalpur, Kalahandi, Keonjhar and Koraput districts of Orissa. Other important bauxite occurrences are located in Bilaspur, Surguja and Raigarh districts of Chhattisgarh, Satna, Balaghat, Rewa and Jabalpur districts of Madhya Pradesh, Lohardaga and Gumla districts of Jharkhand, Kolhapur, Raigad, Satara, Sangli, Sindhudurg, Ratnagiri and Thane districts of Maharashtra, Kutch, Jamnagar, Junagarh, Amreli, Bhavnagar, Sabarkantha, Surat, Valsad and Ahmedabad districts of Gujarat State.
15 major deposits account for 75% of the country's production. These are mostly the captive bauxite mines of the major alumina players in the country like Nalco, Hindalco, Balco, Malco and the mines of GMDC which are either fully mechanized or semi mechanized. Among these, the Panchpatmali bauxite mine of NALCO in Orissa accounts for about 40% of the country's production Resources of bauxite in India as on 1.4.2010, as per UNFC system, are placed at 3,480 million tonnes. By States, Odisha alone accounts for 52% of country's resources of bauxite followed by Andhra Pradesh (18%), Gujarat (7%), Chhattisgarh and Maharashtra (5% each) and Madhya Pradesh and Jharkhand (4% each).

Major bauxite resources are concentrated in the East Coast bauxite deposits in Odisha and Andhra Pradesh.
Presently, Jharkhand is producing about 14% of the total production of the country from the mines situated at Lohardaga, Gumla and Latehar district.

Ashapura Bauxite Business and global Trend

Chetan Shah, Hemul Shah and Ranjeet Mishra
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Abstract

India is a country with rich mineral resources and a is big producer of Coal, Iron Ore, manganese, Bauxite, Lead & Zinc, Limestone, Marble, Granite etc. Processing and value addition of minerals in India is still in its infancy and it provides a great opportunity to Ashapura Minechem to explore these minerals and trade in International market. Abundance of good quality gibbsitic bauxite reserves, dedicated team of highly qualified Mining Engineers and machinery, all weather developed ports in India with huge storage capacity, an R&D lab with quality scientific manpower enables the Ashapura Minechem to explore the mineral and carry out their own mine plan to trade bauxite in global market. Its strong faith in giving back to society by way of effective and efficient CSR plans at all units/mining sites to assist the rural and the under privileged of society in their development including huge government exchequer also encourages the Government clearances. With objectives of ecofriendly systematic mine development, production & pit closure plans as per the norms laid down in mining plan approved by Indian Bureau of Mines – Government of India the Industry proposes to grow by 5.5% by 2017 to meet partially the global demand for bauxite.

Key Words: Bauxite, Bauxite mining, Ashapura Minechem

露天矿系列嵌套境界快速生成方法研究

Study on Rapid Generation Method of Open-Pit Mine Serial Nested Boundaries

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摘要

系列嵌套境界是进行露天矿山最终境界优化分析及矿山排产规划研究的基础，在露天矿山设计及开采规划过程中起着至关重要的作用。针对于此，文章从矿床模型创建、块体参数构成及赋值方法等方面入手，开展了矿山系列嵌套境界快速、高效生成方法的研究。分析了矿床

实体模型和块体模型的构模技术、研究了矿山境界生成所需基础参数的初选方法，对权值参数化境界生成方法进行了深入分析，并提出了解决矿山境界缺口问题的思路。最后以某大型铜矿山为例，进行了应用实践，应用结果表明，基于矿床块体模型参数微调的矿山境界生成方法能实现系列境界快速、高效生成，减少了矿山境界文件获取过程的工作量，为露天矿山系统整体高效优化提供了便捷的方法。

Abstract

Serial nested boundaries, as foundations for the final boundary optimizing analysis and production planning study of an open-pit mine, play a critical role in open-pit mine design and exploitation planning. In that light, this article makes a study of a rapid and efficient generation method of mine serial nested boundaries from the perspectives of mineral deposit model creation, the composition of block parameters, assignment method, etc. This article also analyzes modelling techniques of mineral deposit solid models and block models, studies the method of primarily selecting basic parameters necessary for generating mine boundaries, makes an in-depth analysis of weight parameterization boundary generating method, and puts forward ideas to solve pending problems about mine boundaries. In the end, this article takes a large copper mine as an example to make an application practice analysis. The results show that the mine boundary generation method, based on mineral deposit block model parameter fine tuning, realizes a rapid and efficient generation of serial boundaries, reduces the workload in preparing documents on mineral boundaries and is convenient for optimizing an open-pit mine system fully and efficiently.

关键词：露天矿山；嵌套境界；矿床模型；参数；优化

Keywords: Open-Pit Mine; Nested Boundaries; Mineral Deposit Models; Parameters; Optimization

单频 GPS 载波相位平滑伪距差分技术在矿山车辆安全监控中的应用

Application of Single-Frequency GPS Carrier Phase Smoothed Pseudorange Difference Technology in Mining Vehicle Safety Monitoring

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摘要

分析了 GPS 伪距差分定位模型和载波相位平滑伪距模型，采用开发了相应的程序模块。在某矿区车辆上加装 GPS 接收机对采集数据进行分析，验证了程序模块的正确性，数据处理分析

结果表明，相比伪距差分定位，采用载波相位平滑伪距差分技术监测矿区车辆应用效果相对于一般伪距差分技术要好。

Abstract

This article analyzes GPS pseudorange differential positioning model and carrier phase smoothed pseudorange model and develops and applies corresponding program modules. An analysis of collected data is made by virtue of installing a GPS receiver on some mining vehicle, which has verified the correctness of program modules. Data processing and analysis results show that it is better and more effective to monitor mining vehicles by carrier phase smoothed pseudorange difference technology than by a common pseudorange differential positioning technology.

关键字：载波相位平滑伪距；伪距差分；精密随机模型；矿山车辆监控

Keywords: Carrier Phase Smoothed Pseudorange; Pseudorange Difference; Precise Stochastic Model; Mining Vehicle Monitoring

尾矿库安全在线监测与预警应急智能系统的构架与实现

Study On Safety On-Line Monitoring and Warning & Emergency Intelligent System

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摘要

针对矿山安全生产的需求，开发了矿山安全在线监测与预警应急三维智能系统，该系统能自动化采集、分析、处理和集成多源监测数据，进行三维仿真和真四维矿山安全推演分析，并实现在线应急指挥，为矿山工程安全在线监测提供一整套解决方案。

Abstracts

According to the requirements of safety mining production, an online SME system is developed. This system can collect, analyze, process and integrate multi-source monitoring data automatically. It also realizes three-dimensional terrain simulation, mine safety's four-dimension deduction analysis and emergency command online. The system provides a complete solution for on-line monitoring of mining safety.

关键词：矿山安全；在线监测；三维仿真推理；应急指挥；干滩自动化监测

Keywords: mine safety, online monitoring, three-dimension simulation, emergency command, beach automatic monitoring

测量机器人在尾矿库安全监测中的应用研究

Application and Research on Measurement Robot in Safety Monitoring of Tailing Pond

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摘要

测量机器人监测精度高、无人值守自动化程度高，且监测点位布设较多时监测成本相对较低，是对尾矿坝表面位移进行全天候实时高精度监测的一项重要手段。要实现测量机器人测量过程的远程自动控制，必须研发相配套的数据采集设备及软件，同时应配备数字式气温气压计以实现测距气象改正。本文以 Leica TCA2003，TS30，TM30，TS1201+等多系列测量机器人为例，设计测量机器人远程自动控制系统，控制系统通过机器人内置的 GeoCOM 协议与之通信，并协同完成测量过程。测量数据实时传输到服务器，实现远程实时在线监测。

Abstracts:

The measurement robot is an important method for the all-weather real-time precise monitoring of surface displacement of tailing pond, with high accuracy, high degree autoimmunization without man operation and low monitoring cost during more monitoring points. For the remote automatic control during the measurement of measurement robot, the matched data collection devices and software must be developed, and the digital temperature & pressure meter should be provided to correct the distance-measurement meteorology. Taking measurement robot Leica TS30 for the example, the control system communicates with the robot through the GeoCOM inside to complete the measurement. The measured data are sent to the server in real time to achieve the remote real-time online monitoring.

关键词：测量机器人 变形监测 尾矿库安全监测 GeoCOM

Keywords: measurement robot, deformation measurement, tailing pond, GeoCOM

深井开采主要技术难点分析及对策

The Analysis on Technique Questions of Deep Mining and Its Measures

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摘 要

由于开采深度的增加，深井开采使矿山的岩石力学性质和地应力特征发生明显改变，深井开采存在高应力、高温、高岩溶水压、采矿扰动的地质环境特征。本文通过对深井开采主要技术难点分析；并做了一定的技术和工程改造研究,为深井开采创造合适的开采环境和深部难采条件下的采安全生产作了指导。

Abstract

The rock mechanics and the ground stress of mines take place obvious change by increment of mining depth, the deep mining has the characters of the ground stress ,high ground heat, high water pressure, and mine for minerals perturbation .This text through the analysis to the deep well of technique questions, combining some certain of technique and engineering reformation research, mine a creation for the deep well accommodation of mine environment with deep the department be difficult to adopt under the condition of adopt safety produce made instruction.

关键词：深井开采；岩爆；地压；地温；岩石力学

Key Words：Deep Mining; Rock Burst; Ground Press; Ground Heat; Rock Mechanics

浅谈降低入磨铝土矿品位波动的措施

Discussion on Measures to Reduce Bauxite Grade Fluctuation to Mill

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摘要

通过改善装载、运输、卸矿，调节皮带输出、优化布矿距离，实现各个区域不同品位、不同时间段矿石的均衡搭配，减小入磨矿石品位的波动。

Abstract

Realize homogeneous proportioning of bauxites ores in different grades and periods from various areas thus to reduce ore grade fluctuation to mill by improving loading and transportation, adjusting belt and optimizing ores distribution distance.

Keywords: bauxite, homogenization, effect

某大型铝土矿开采引起地表沉降的三维数值分析

3D-numerical Simulation on Surface Settlement due to Underground Mining of a Large Bauxite

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摘要

地下矿山开采引起地表沉降是采矿研究的重要课题，本论文针对某大型铝土矿，采用三维数值模拟的手段，分析在不同开采条件、不同开采顺序下地表沉降情况，得出开采引起的地表变形，是以地表沉降位移为主的，水平方向上位移很小；地表沉降变形与采矿方法（开采参数的选取）有很大关系。同时对采矿方法及其参数的进行优化研究；分析矿柱的应力状态对维护采场顶底板围岩的稳定至关重要。

Abstract

Surface settlement due to underground mining is an important topic of mining research. To obtain the surface deformation of a large bauxite caused by mining, the different excavation conditions and excavation sequences are analyzed by using 3D - numerical simulation tool. While the mining method and its parameters are optimized. The results shows that the surface deformation which caused by underground mining is mainly affected by surface settlement displacement which relevant to mining methods (extraction parameter selection), and the horizontal displacement is small, analysis of the pillar's stress state is highly important to maintenance the stability of the roof and floor.

关键词：铝土矿；地表沉降；数值计算；矿柱应力状态

Key words: bauxite; surface settlement; numerical simulation; pillar's stress state

氧化铝过程控制及生产管理优化探讨

Discussion on Alumina Process Control and Production Management Optimization

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摘要

随着工业自动化水平的不断提高，过程控制已由原先的保证生产稳定运行朝着最佳化控制生产过渡。拜耳法氧化铝生产能效优化控制技术，是氧化铝生产过程的核心技术的具体体现，关系到工厂的正常运转，关系到生产技术经济指标的好坏及工厂自动化的实现等诸多重大问题，具有突出重要的地位。本文就拜耳法是氧化铝生产工艺，阐述了其目前的控制技术及对未来的展望。

Abstracts

With continuous improvement of industrial automation level, the process control target has been changed gradually from ensuring stable production to the optimum production control. The Bayer alumina production energy efficiency optimization control technology is the specific performance of the core technology in the alumina production, related with the normal operation of the plant, the production technical and economic index and plant automation conditions etc.., and plays the important role. The essay specifies the current control technology and its future prospect of Bayer alumina production process.

关键词：过程控制，检测控制技术，控制系统，软测量技术，智能化专家优化系统

Key Words: process control, detect & control technology, control system

拜耳法氧化铝生产流程系统优化软件的开发探索

Development on Software for Optimization of Bayer Alumina Production Flow System

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摘要

利用现有的信息化资源，开发一个软件，对氧化铝生产流程进行优化检测，确定溶出、分解、蒸发等关键运行效率的量化指标；根据此效率指标，以市场为导向，综合氧化铝产品以及原材料市场价格因素，得出在生产指标上虽不一定最佳、但在经营效益上最佳的优化决策方案。

Abstract

A kind of software is developed with the existing informatization resource, for optimization and detection of alumina production flow, so as to determine the quantitative index of digestion, precipitation and evaporation etc. The best optimized decision proposal on management efficiency is obtained as per above efficiency index and with market-oriented.

关键词：氧化铝生产 优化检测 优化决策 模块

Keywords: alumina production, optimization and detection, optimized decision, module

平果铝赤泥堆场外坝外边坡护坡的生产实践

Production Practice on Slope Protection of Outer Dam of Red Mud Yard in Pingguo Alumina Plant

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摘要

本文阐述了平果铝赤泥堆场边坡护坡的经验和做法，生产实践表明，赤泥堆场植被护坡不仅有助于边坡的稳定,而且恢复了堆场库坝区的生态，是理想的赤泥堆场护坡模式。

Abstracts

The experience and practice on slope protection of outer dam of red mud yard in Pingguo Aluminum Plant is put forward. It shows that the slope protection with vegetation not only is good for slope stabilization, but also regains the ecology in the area of dam, which is the ideal slope protection mode for red mud yard.

关键词： 赤泥 堆场 边坡 护坡 植被

Key words: red mud, yard, slope, slope protection, vegetation

氧化铝工业精益设计和运营探讨

Lean Design for Efficient Operation of Alumina Refinery

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摘要

随着能源成本的上升、环保压力的增加、铝产能的过剩，经济效益大幅下降，铝工业企业必须转变原有的传统模式，走精益化的道路，才能确保企业有较强的竞争力。本文介绍了氧化铝工业近年来精益设计和运营情况，对同行企业具有一定的学习借鉴作用。

Abstracts

With the increasing energy cost and environment protection pressure, excess aluminum capacity and reducing economical benefit, the aluminum enterprises must change the traditional mode to the lean mode, so as to ensure the stronger competiveness. The lean design and operation on alumina refinery is introduced, with reference function for the industry.

关键词：氧化铝；精益；余热利用；成本

Key words: alumina, lean, waste heat utilization, cost

一水硬铝石生产氧化铝中的石灰用量优化应用实践

Optimization of Lime Consumption in Alumina Production by Diaspore

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摘要

本文介召了一水硬铝石铝土矿生产氧化铝的溶出过程中添加石灰用量的优化控制机理，结合某氧化铝厂的生产实践，介召了利用《氧化铝生产标准量化模型》确定生产效益最大化的最佳石灰用量的方法，总结了提高石灰添加量准确度的实践经验以及石灰用量优化控制情况和实施效果，对氧化铝厂优化控制石灰用量具有一定的指导意义。

Abstracts

This paper introduces the optimal control mechanism of lime consumption during the aluminum oxide producing by diaspore bauxite. Combining with the producing practice in an Alumina Plant, it also introduces the best consumption plan to maximize the productivity effect by using the aluminum oxide production standard quantitative model. This paper concludes the practical experience of enhancing the accuracy of lime additive amount and the optimal control plan of lime consumption, which supplies optimal lime consumption plan to alumina plants.

关键词：石灰 用量 优化 控制

Key words: lime, consumption, optimized, control

优化工艺制度提高拜耳循环效率的工业实践

Practice on Optimizing Process to Improve Bayer Circulation Efficiency

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摘要

在现有设施条件下，基于拜耳法循环效率理论，氧化铝生产系统对分解工艺、蒸发工艺、磨矿工艺、溶出工艺、石灰焙烧等工艺制度进行优化，可以提高氧化铝系统母液循环效率，实现增产降耗、挖潜增效的目的。

Abstract

Under the current facilities conditions and based on the Bayer circulation efficiency theory, the process system optimization on precipitation, evaporation, milling, digestion and lime calcinations etc. of alumina production system can improve mother liquor circulation efficiency of alumina production system to realize the production-increasing & consumption-decreasing.

关键词：循环效率；工艺制度；挖潜增效

Keywords: circulation efficiency, process system, potential-tapping & efficiency-increasing

开展预防性维修提升设备可靠性

Equipment Reliability Improvement by Preventive Maintenance

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摘要

某铝厂生产线上的锅炉故障频发，影响了生产正常进行，且故障成本高，2012 年故障成本 3713.6 万。该铝厂通过开展设备预防性维修，提升设备可靠性，降低设备故障次数，改善设备能力，有效地保障生产连续、稳定进行，且大幅度降低生产成本。

Abstract

The boiler breakdown happens frequently in some aluminum plant, which not only affects the normal production, but also increase the breakdown cost with being 37.136 million Yuan in 2012. The preventive maintenance is carried out in such plant, so as to improve the equipment reliability, reduce the frequency of equipment breakdown and improve the equipment capability, thus guarantee the continue stable running and reduce the production cost greatly.

关键词：预防性维修 设备可靠性 设备故障总成本

Key words: preventive maintenance, equipment reliability, total breakdown cost of equipment

低品位—水硬铝石的拜耳法生产技术

Bayer Process Production Technology for Low-grade Diaspore

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摘要

国内铝土矿资源日益枯竭，品位急剧下降，给拜尔法氧化铝生产企业带来了极大的困难，提出了新的挑战。采用价廉物美、成熟可靠的先进技术和装备，优化技术指标，严格生产管理，是应对铝土矿资源贫化的有力手段。

Abstract

Domestic bauxite resources have increasingly depleted and the grade has sharply dropped which brings great troubles for Bayer process alumina production enterprisers and gives a new challenge. The powerful means to cope with the depletion of bauxite resources are high quality and inexpensive, mature and reliable advanced technology and equipment, optimal technical indicators, strict production management.

关键词：低品位铝土矿　拜尔法　技术装备　优化设计

Key words: low-grade diaspore, Bayer process, technical equipments, optimal engineering

高铝粉煤灰预脱硅同步降低碱含量研究

Research on Alkaili Content Reduction During High Alumina Fly Ash Pre-desilication Process

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摘要

针对高铝粉煤灰预脱硅后碱含量高，影响后续提铝系统经济稳定运行的问题，研究了预脱硅同步降低碱含量的调控规律及控制机理，并得到了最佳工艺条件。在温度 90℃、氧化钠浓度 120g/L、反应时间 2.5h、液固比（V/M）3：1 条件下，脱硅高铝粉煤灰中氧化钠含量为 2.8%，铝硅比由 1.3 提高为 2.12，氧化硅溶出率为 39.4%，氧化铝溶出率为 0.6%，实现了高铝粉煤灰预脱硅后碱含量最低且预脱硅效率最大化。高温、高碱浓度促进了方钠石物相（$Na_8Si_6Al_6O_{24}(OH)_2\ (H_2O)_2$）的生成，而不利于降低脱硅灰碱含量，通过延长反应时间、降低温度和碱浓度的方法可以调控脱硅灰碱含量且提高其铝硅比。

Abstract

Specific to the problem of alkali content of high alumina fly ash is relatively high after pre-desilication process, which prevents the alumina extraction system from economically and stably operating. We studied the regulation rules and controlling mechanism of pre-desilication synchronous in order to

reduce the alkali content. At the temperature of 90 ℃, the sodium oxide concentration is 120g/L. Reaction time is 2.5h. Liquid solid ratio (V/M) is at 3:1. The removal of sodium oxide content of desilication high aluminum fly ash is at 2.8%. The alumina-silica ratio increases from 1.3 to 2.12. The silicon oxide leaching rate is at 39.4%. The leaching rate of alumina is 0.6%. It realizes that the alkali content in the high alumina fly ash is the lowest after pretreatment desilication and the desilication efficiency is maximized. High temperature, high alkali concentration promoted the sodalite phase (Na8Si6Al6O24 (OH) 2 (H2O) 2) generation, but is not helpful to reduce the content of alkali silica fume. By prolonging the reaction time, decreasing the temperature and concentration of alkali, the method can control the alkali content of silica fume and increase the alumina-silicon ratio.

关键词： 高铝粉煤灰 预脱硅 化学碱 铝硅比

Key words: high alumina fly ash, pre-desilication, chemical alkali, alumina-silica ratio

正确使用标准品改善铝工业分析结果

How to Use CRMS Correctly to Improve the Analysis Results in Aluminum Industry

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摘要

本文讲述了工业分析中标准物质的定义,标准物质的研制生产,标准物质的使用,标准物质的证书,有效期和标准物质生产者具有的资质.铝工业生产中所能涉及的标准物质的种类,以及如何根据铝工业分析中不同的分析方法选择正确的标准品来改善铝工业分析的结果.

Abstract

This article introduced the definition, development, usage, certification and expiration of the reference materials in the aluminum industry, and most kinds of CRMS fitted to the aluminum lines, told how to choose the right CRMS to improve the analysis results in the aluminum industry.

关键词：标准物质 铝合金标准物质 矾土标样 赤泥标样 铝土矿标样 氧化铝标样

Key words: Reference materials, Alumina, Red mud, Bauxite, Aluminum Oxide, Aluminum Alloys, Cryolite.

赤泥提取有价金属资源化利用研究

Study on Comprehensive Utilization of Recovering Valuable Metals from Red Mud

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摘要

随着氧化铝工业的发展，赤泥的堆放及危害已成为日益严重的环境问题，如何综合有效地利用赤泥已刻不容缓。本文介绍了赤泥的基本性质，国内外赤泥在综合利用方面的研究进展，并通过火法和湿法两方面对赤泥的综合利用进行了阐述。火法中还原焙烧—磁选工艺和直接还原进行铁元素的提取；湿法中采用盐酸和硫酸酸洗浸出提取钪、钛、铁、铝元素，针对赤泥中含有铁、钪、钛、铝有价元素的特点，提出了资源化利用赤泥的原则，为今后的赤泥资源化利用提供重要的指导意义。

Abstract

With the rapid development of alumina industry, it becomes increasingly important to reduce the pollution and damage caused by red mud. So, it is rather urgent to utilize it effectively. This paper introduces the fundamental character of red mud. The research progress of comprehensive utilization on red mud is summarized on home and abroad, which contains pyrometallurgical process such as reduction roasting-magnetic separation process and indirect reduction for extracting iron element , hydrometallurgical extraction such as hydrochloric acid pickling and sulfuric acid pickling for scandium element, titanium element, iron element and aluminium element. According to the iron, scandium, titanium, aluminium characters of the red mud, the comprehensive utilization principle of the red mud is discussed, which provides the significant guidance on the red mud comprehensive utilization.

关键词：赤泥，火法工艺，湿法工艺，资源化利用

Key word: red mud; pyrometallurgical process; hydrometallurgical extraction; comprehensive utilization

粉煤灰硫酸铵混合焙烧提取粉煤灰中氧化铝的研究

Study on Alumina Extraction from Pulverized Fuel Ash by Mixed Calcination of Pulverized Fuel Ash & Ammonia Sulfate

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摘要

以粉煤灰和硫酸铵为原料，经混合焙烧、熟料浸出、固液分离、浸出液沉铝等过程提取粉煤灰中的氧化铝。本文研究了配料比、焙烧温度、焙烧时间对粉煤灰中氧化铝提取率的影响，并打通粉煤灰提取氧化铝的整体流程。在最佳条件下，粉煤灰中氧化铝提取率可达 85.7%。焙烧过程产生的氨气回收后用于浸出液沉铝，沉铝后的溶液为硫酸铵溶液，经蒸发结晶后返回配料，整个流程实现了硫酸铵的循环利用。

Abstract

Alumina is extracted from pulverized fuel ash via processes of mixed calcination, clinker leaching, solid-liquid separation and leached solution settlement etc. with raw materials of pulverized fuel ash and ammonia sulfate. This paper makes a study on the influence of proportioning ratio, calcination temperature and duration on alumina extraction yield, and makes a statement on the whole process flow for alumina extraction from pulverized fuel ash. Under optimum conditions, the extraction yield of alumina from pulverized fuel ash can reach 85.7%. Ammonia produced during calcination is used in leached solution settlement process, solution after settlement is ammonia sulfate solution, this solution returns to proportioning after evaporation and crystallization, ammonia sulfate is recycled in the whole process flow.

关键词：粉煤灰；硫酸铵；氧化铝；焙烧

Key words：Pulverized Fuel Ash；Ammonia Sulfate；Alumina；Calcination

管道化溶出新蒸汽冷凝水利用方式分析

Analysis on Utilization of Fresh Steam Condensate Water in Tube Digestion

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摘 要

为了更合理的利用管道化溶出工序新蒸汽冷凝水的热量，通过对新蒸汽冷凝水的两种利用方式的研究，对（火用）效率、设备投资、能量消耗、可操作性四个方面对比分析后，总结了采用闪蒸新蒸汽冷凝水后产生的二次蒸汽加热矿浆与新蒸汽冷凝水间接换热加热矿浆各自的优缺点，得出选择最佳利用途径应考虑设备投资与能耗的综合影响。

Abstract

In order to utilize the heat energy of the fresh steam condensate water in tube digestion working section, this paper makes a summary on the respective advantages and disadvantages of two utilization methods (to heat slurry with secondary steam produced from fresh steam condensate water by flash evaporation; and to heat slurry with fresh steam condensate water by indirect heat exchange) based on the study on such two utilization methods and a comparison and analysis on four aspects of (exergy) efficiency, equipment investment, energy consumption and operability, and concludes that the comprehensive effects of equipment investment and energy consumption shall both be considered for selecting optimum utilization method.

关键词：管道化溶出；（火用）损失；新蒸汽冷凝水；传热系数；汽耗；闪蒸

Key Words: Tube Digestion, (Exergy) Loss, Fresh Steam Condensate Water, Heat Conductivity Coefficient, Steam Consumption, Flash Evaporation

多雨地区建设氧化铝厂需要注意的几个问题

Some Items be considered in Building Alumina Refinery in Area with Abundant Rainfall

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摘 要

本文简单介绍了氧化铝厂用水收支项目构成，明确了影响氧化铝厂水平衡的关键因素。针对热带地区瞬时降雨量大，旱季雨季雨量差别显著的情况，分别从设计理念、设施配备、运行策略等方面论述了如何维系氧化铝厂水收支平衡。其中，设置废水储存设施、实现雨水快速分流、有效利用赤泥堆场缓冲容量、对废水进行处理后外排等方式，可以有效降低降雨不均

对氧化铝厂水平衡的不利影响。同时，对多雨地区建设氧化铝厂的厂房结构围护，设备防护等级选择、配置也提出了一些建议。

Abstract

The structure and key effect factors of water balance in alumina refinery are introduced. In tropical area, there has abundant rainfall in rain season and less rainfall in dry season, so some work should be done in design and construction to maintain water balance of alumina refinery, such as design idea, machine fitted, operation procedure ect. Among the measures, set waste water storage tanks, separate rain water from process, use red mud residue buffer capacity and deal with waste water can well decrease the poor effect of rough rainfall to water balance. In addition, some suggestions are given in workshop structure and motor protection.

关键词：多雨地区 氧化铝厂 水平衡

Key words: area with abundant rainfall, alumina refinery, water balance

降低拜耳法氧化铝生产能源消耗的措施分析

Analysis on Energy Conservation during Bayer Process

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摘要

本文对于国家相关政策做了介绍，对氧化铝厂使用的能源种类进行了分析，对主要能源价格趋势做了预测，对国内外几个典型氧化铝生产企业的能耗水平进行了分析，以图表的形式逐项列出了氧化铝生产各主要耗能单元的能耗分布，由此总结出了降低拜耳法氧化铝生产能源消耗的可行措施及对全流程节能的贡献，对于氧化铝从业者宏观的掌握拜耳法氧化铝生产节能降耗的工作方向，具有一定的指导作用。

Abstract

The relevant policies of China was presented in this paper. Also the species of energy resource used in the refinery was analysed, the trend of major energy resource's price was forecasted. The energy consumption level of some typical refineries both here and abroad were analysed, the energy consumption distribution of major units were listed as diagram item by item, summarized some possible steps about energy saving during Bayer process, also the contribution of the steps to the whole

process energy conservation. This paper will do the guiding role for the practitioners of alumina to master the working aspect of energy conservation.

关键词：拜耳法；氧化铝；节能

Key words: Bayer process; alumina; energy conservation

杂质对氧化铝产品质量的影响及对策浅析

Basic Study of the Effects of Impurities on the Alumina Product Quality and Countermeasure

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摘要

随着电解铝生产技术进步及对环境保护的日益重视，粉状氧化铝已无法满足现代电解铝生产的需要，生产砂状氧化铝势在必行。本文分析了国内外氧化铝产品在化学成分和物理性能上的差异，探讨了氧化铝产品中二氧化硅、氧化钠、氧化铁等杂质对电解铝生产的影响，提出了杂质全流程行为控制，改善种分工艺，合理控制粒度分布、降低磨损指数、控制合理的焙烧工艺条件等对策。

Abstract

With the development of aluminium smelting technology and greater attention given to the environmental protection. Powdery alumina has been unable to meet the needs of modern electrolytic aluminum production, it is urged to product sandy alumina. The difference between domestic and foreign aluminum products in the chemical composition and physical properties are analyzed in this paper. Effects of silicon dioxide, sodium oxide, iron oxide and other impurities in alumina products for electrolytic aluminum production are discussed. Some countermeasures are proposed such as: control the behavior of impurities in the whole process, improve precipitation process, the reasonable control of particle size distribution, reduce the attrition index, control the reasonable calcination conditions etc.

关键词: 电解铝；砂状氧化铝；产品质量；对策

keywords：electrolytic aluminum；sandy alumina；product quality；countermeasures

种分槽高性能超低能耗搅拌装置的研发

Development of Agitating Device with High Performance & Ultralow Power Consumption for Seed Precipitator

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摘要

用 fluent 软件对铝酸钠氢氧化铝料浆在搅拌槽内的流动特征、桨叶搅拌效果和功率消耗等进行了数值模拟，通过小型实验槽和中型工业搅拌槽的测试验证，找到了正确的数学模型和边界条件设置，使模拟和实测达到吻合一致。模拟计算采用多面体网格、滑移网格法和标准 k-ε 湍流方程，铝酸钠含氢氧化铝体积分数为 33%。然后用 fluent 软件模拟得到了优化的桨叶形状、桨叶离底间距、桨叶直径与槽径比、桨叶配置形式和料浆流动路线，并开发了高性能 HSG/HQG 组合搅拌桨。用 fluent 软件数值模拟，将 HSG/HQG 组合搅拌桨与大型搅拌槽使用的 Intermig 搅拌桨和 CBY 长薄叶搅拌桨进行性能对比。结果表明，在同样的物性参数下，HSG/HQG 组合搅拌桨比 Intermig 搅拌桨和 CBY 长薄叶搅拌桨能耗降低 40%左右，槽底部无结疤，同时具有大排量和底剪切的特点。从 2012 年 6 月份开始，新型搅拌桨首先应用在山西铝厂的φ6.5X10 米氢氧化铝搅拌槽上，使用一年多时间，搅拌效果良好无沉淀结疤，节能效果显著，证明 HSG/HQG 组合搅拌桨确实具有优越的性能。

Abstract

Numerical simulation on the flow features of sodium aluminum hydroxide slurry in agitator, blade agitating effect and power consumption etc. is carried out with fluent software, correct mathematic model and critical conditions setting are found through tests in small test and middle industrial agitators, so as to make simulation same as practical test. Polygon mesh, sliding grid method, k-ε turbulence equations, and hydrate volume fraction of 33% in sodium aluminate solution are used for analog computation. Then, optimized agitating blade shape, gap between blade & agitator bottom, ratio of blade diameter & precipitator diameter, blades arrangement and slurry flow route are obtained, and HSG/HQG combined agitating blade with high performance is developed with fluent software. By numerical simulation with fluent software, a performance comparison among HSG/HQG combined

agitating blade, Intermig agitating blade (used in large agitator) and CBY long filmy agitating blade is carried out. It's shown by comparison results, under same physical parameters, with HSG/HQG combined agitating blades, power consumption is reduced by around 40%, no scaling at agitator bottom, as well as with features of large capacity and bottom shearing, compared with Interning and CBY agitating blades. This new agitating blade was first used in the φ6.5X10 hydrate agitators in Shanxi Aluminum Smelter in June 2012. Results of good agitating effect, no scaling and great power-saving have been obtained since operating for more than one year, it's proven by practice that HSG/HQG combined agitating blade is really of excellent performances.

关键词：搅拌式反应器 种分槽 计算流体力学 INTERMIG 搅拌桨 BRUCATO 曳力模型 低能耗搅拌装置

Key Words：Stirred Tank Reactor；seed precipitation tank；Computational fluid dynamics；Intermig agitating blade；BRUCATO drag model；Low power consumption device

赤泥滤饼的基本性质

Comprehensive Benefit Analysis of Alumina Plant Wet Red Mud Yard Dry Compatibilization

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摘要

本文以中国铝业贵州分公司干法赤泥滤饼为例，从化学成分、颗粒分析、土力学等方面全面研究了烧结法和拜尔法赤泥性质。

Abstract

In this paper, take the Guizhou branch of China Aluminum Corporation dry red mud filter cake for example, the chemical composition, particle size analysis, soil mechanics and other aspects of a comprehensive study on the sintering and Bayer red mud properties.

关键词：赤泥；滤饼；性质

Key words: red mud，filter cake， properties.

低品位铝土矿细菌脱硅效果研究

Study on Bioleaching Silicon from Low-grade Bauxite

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摘要

我国广西桂中地区高铁三水铝土矿储量丰富，但由于铝硅比较低，且铁含量较高，一直未能经济利用。为实现该矿的综合利用，试验采用摇瓶浸出方法研究了影响硅酸盐细菌浸矿脱硅的各种条件。结果表明，在最佳条件下，铝土矿铝硅比从 4.99 提高到 6.23，硅酸盐细菌对该矿具有一定的脱硅能力。

Abstract

Thehigh-irongibbsite-type bauxite reserve in central Guangxi is very rich, but most of it is low grade, and the iron content is high, itcannot be economical utilized. In order to multipurpose utilize of the bauxite，the conditions influencing the desilication of ore leaching with silicate bacteria are studied by sole shake flask leaching experiment. The results show that the ratio of $Al_2O_3$to SiO_2 (A/S)in samples is increased from 4.99 to 6.23.The leaching results indicate that leaching with silicate bacteria is useful in the improvement of low-grade high-iron bauxite.

关键词：高铁; 低品位;铝土矿；硅酸盐细菌；铝硅比

Key words: high-iron;low grade; bauxite; silicatebacteria; the ratio of $Al_2O_3$to SiO_2

翻盘过滤机在氧化铝生产中的应用

Application of a Kind of Vacuum Rotating- type Discharge Pan Filter in Alumina Refinery Field

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摘要

液固分离是几乎所有冶金等化工流程中不可避免的工序，并且可能在流程中的各个工段使用，比如在氧化铝的生产流程中，不同车间的液固分离就会用到沉降槽、立式叶滤机、真空立盘过滤机、真空水平盘式过滤机等。目前有一种翻盘过滤机已经在氧化铝厂投入使用，用于烧结法流程中代替沉降槽实现液固分离，效果良好。

Abstract

Solid-Liquor separation is almost a unavoidable step in chemical industry such as metallurgy process, even present in several workshops in a plant, such as, settler, diastar filter, vacuum vertical filter, vacuum pan filter are adopted in a alumina refinery. Now a kind of vacuum rotating- type discharge pan filter has joined the group, used for separation of digestion slurry in sintering method alumina process, the filter took the place of settler.

关键词：氧化铝生产；翻盘过滤机；液固分离；增产扩建；

Key words: Alumina process; vacuum rotating-type discharge pan filter; Solid-Liquor separation; Alumina refinery expansion

浅议精益工具在铝企业盘存工作中的运用

Application of Six Sigma Management Tool in Improving Inventory Accuracy

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摘要

盘存工作在铝企业生产经营管理中起着重要的作用，原燃物料、中间产品、产品产量的库（仓）存变化要通过盘存来确定，从而确定原燃物料的消耗、中间产品的用量和产品产量，所以盘存的准确性对消耗、产量的确定起着关键的作用，如何提高盘存精度，一直是一个问题，也是一个课题，本文采用精益管理问题解决工具，对影响盘存精度的原因进行查找和分析，找出根本原因，提出提高盘存精度的措施和方法。

Abstract

Stocktaking plays an important role in production and operation management of aluminium enterprises. Inventory changes of raw materials and fuels, intermediate products and products are all confirmed through stocktaking, which is a key link for confirming the consumption of raw materials, fuels and intermediate products, and future product output. Therefore, stocktaking accuracy is critical to the calculation of consumption and output. The method for improving stocktaking accuracy has been an issue studied in articles. This article applies lean management solution tools to find out and analyze the reasons affecting stocktaking accuracy and proposes measures and methods to enhance stocktaking accuracy.

关键词：精益管理 工具 铝企业 盘存

Keywords: Lean Management, Tool, Aluminium Enterprises, Stocktaking

MULTIPLE BAUXITE DEPOSITS & PROJECTS IN GUYANA

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Abstract

This paper discusses First Bauxite Corporation's (FBX) mineral reserves in Guyana which can be used: to supply metallurgical grade bauxite to the aluminum industry; to produce an 88%+ bauxite sinter for the refractory industry; or to produce ceramic proppants for the oil and gas industries. Extensive lab testing, customer sample distribution and pilot plant production of the high alumina sinter (Guysin®) refractory grade bauxite has been completed. Development of an intermediate strength proppant (GuyProp®-ISP) has also been completed and this product is fully comparable to the best industry standards. Development of a light weight proppant (GuyProp®-LWP) and a high density proppant (GuyProp®-HSP) is nearing completion.

First Bauxite had various marketing studies conducted, completed all required feasibility studies, completed plant engineering, and all Guyanese government permits have been approved. The company is now seeking funding partners for construction of a production plant.

Reducing Particle Breakage in Alumina Calcination

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Abstract

The gibbsite morphology and strength has a major impact on subsequent particle breakage in alumina calcination. However, also the calcination step contributes to the generation of fines in the final product. The particle breakage in calcination is depending on calciner design and operation.

Outotec has made several improvements to their Circulating Fluidized Bed calcination technology in order to reduce the particle breakage. Breakage in the newer generation of calciners is approaching the low level observed in rotary kilns. Several of these technology and process control improvements can be retrofitted in old plants to improve the performance with regards to breakage and energy consumption.

For efficient utilization of the alumina in the aluminium smelter the nature of the fine particles, rather than the quantity, is also of high importance. Outotec's CFB calcination technology results in a uniform product quality with low alpha alumina content and only traces of residual gibbsite.

Three-dimensional Numerical Analysis of Ground Surface Settlement of Large-scale Bauxite Mine

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Abstract

In the large-scale sedimentary bauxite mine, the main roof is sticky shale, carbon shale and clay mineral, and at places roof is coal bed, limestone or sandstone. The roof of mine body consists of iron shale, sandstone and hematite. Some enterprises, residences and farmlands located on the mining surface face the issues of ground surface settlement resulted by the large area of underground mining. Therefore it is necessary to study the ground surface stability. In this paper, 3-D numerical simulation method is adopted aimed at a large-scale bauxite mine to analyze the ground surface settlement under different mining conditions and mining orders. The present work concludes that the ground surface deformation by the mining is mainly responsible for ground surface settlement with small horizontal displacement. This ground surface settlement deformation has direct relationship with the mining methods (option of mining parameters) and its parameters can be optimized. It is found that the stress state of ore pillar is important for the maintenance of surrounding rock of roof and floor.

Key Words: Sedimentary bauxite deposit, subsidence, bauxite mining

Material composition of Bauxite concentrates from GIA NGHIA Bauxite mine and general review of its effects on the Red Mud Settling Process

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Abstract

The correlation between the material composition of the bauxite and settling of red mud was discussed. An X-ray diffraction method was used to determine the mineralogical composition of bauxite concentrates from Gia Nghia bauxite mine in Dak Nong province, Vietnam. Results from this research helps reviewing effects of the composition on the red mud settling. Based on this fact, we have carried out some measurements to accelerate the red mud settling process in digestion of bauxite exploited in Gia Nghia Mine.

Key word: Red mud settling, bauxite concentrate, mineralogical composition, diffraction.

An Approach for Low Grade Bauxites and its Impact on Residue Management

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Abstract

For the aluminum industry, in general, the issue of waste is a key factor for Business development. For low grade bauxites, the problem is enlarged and may become serious. Many studies have been completed and others are still in progress to use bauxite residue and some applications exist. But one of the most powerful ways is to reduce the amount of the typical bauxite residue.

The IB2 is one of these possibilities. The first purpose of this process was to reduce the soda consumption of high silica bauxite processing thus reduce cost. This is reached through the use of the RLP (Roast Leach Process). But it also allows a significant reduction of red mud quantities. The laboratory work performed permitted to define and optimize the operating conditions. It has permitted to reduce the total raw material and energy cost despite an increase in energy consumption. This is the IB2 Process.

A bauxite with 60 % Al203 and 15 % SiO2 is transformed into 65 % and 5 %. Then the Lime Bayer Process is adapted to the improved bauxite in order to reduce the Bayer energy consumption and optimize the alumina recovery.

The amount of red residue is reduced by about 40 %. This reduction is of course dependent of the settings of the Bayer Process. An important parameter is the amount of lime used. However, while there is a decrease in the amount of "red residue" there is also production of a stable "white residue" the Calcium Silicate. The volume is in the same order of magnitude as the decrease in red residues. Depending on its purity it can be marketed for certain applications. So far the priority was the operating costs. Due to the importance of the residue issue, the priority will be to focus on the calcium silicate quality optimization.

Chemical and Mineralogical Characteristics of Goa Bauxite, India and Potential of Uses in Alumina and Non-metallurgical Industry

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Abstract

With the increasing demand of bauxite in the world, many high silica laterite-bauxite deposits, neglected in the past by Alumina Refiners, now play important role in export of metallurgical grade bauxite. Goa bauxite mine is one of such deposits, located near the well-developed port, offers an excellent opportunity of bauxite export from west coast of India. Bauxite is fully gibbsitic in nature, having about 40% alumina and 8% silica (about 80% reactive). With the lower cutoff grade of alumina and silica, resources in the deposit may go up to 70 million tons, although systematic exploration work is yet to be carried out in this deposit. Present paper describes the potential of this deposit with detail characterisation of ore and associated laterites. Company is presently exporting bauxite to alumina refineries world over and also supply laterites to cement plants, where quality specification is much relaxed.

Challenges in each stage of a Green Field Alumina Refinery - Concept to Commissioning

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Abstract

In this era of Consumerism, even though there are enough perceived opportunities for investments and Good Projects, to be conceived and implemented, the risks are also equally very high. Also since the present development is mostly in the “Developing and or BRIC Nations”, there seems to be lots of hurdles – partly due to the structure and partly due to the self-created impediments, in these countries. Added to this are the market forces, which is creating peculiar hurdles in which the Project / Production agencies, seem to be losing out fast to the intermediaries.

Almost all the recent Green Field Alumina Refinery projects in the World has been developed in the BRIC countries and all of them are facing hurdles in one way or the other – be it Capital availability, Raw Material supplies, work force availability etc.. Except for China were Projects from Concept to Commissioning takes 3 – 4 years, in other parts of the World, it has taken any were between 8 – 15 years, which completely creates a changed picture for the Project on completion from when it was conceptualized. This paper brings out the challenges posed, risks required to be addressed etc.., in each stage of the Project, so that with the implementation of the Project, all stake holders are benefited.

Novel Thermometric Endpoint Titration (TET) Procedure for the determination of Aluminium

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Abstract

A novel thermometric endpoint titration (TET) procedure for the direct determination of aluminium in a range of sample matrices is a superior replacement for the traditional complexometric (chiefly EDTA) back-titration titration methods, both manual and potentiometric. The method offers analytical precisions typically less than 0.1 % rsd, is capable of full automation, and is carried out at room temperature.

The procedure is suitable for the determination of aluminium in solutions of aluminium sulfate (alum), aluminium chloride, aluminium chlorohydrate, polyaluminium chloride, sodium aluminate; as well as in formulations for anti-perspirants. It may also be applied to the analysis of aluminium in anodizing and etching baths. Other applications include the determination of available aluminium in bauxite, after alkaline "bomb digestion".

Sample preparation involves ensuring that all aluminium is present as Al^{3+}, and buffering in a pH range of approximately 3-4.5 with an acetate buffer. The aluminium is then titrated with a standard fluoride solution in the presence of an excess of sodium and potassium ions. The resultant formation of insoluble NaK_2AlF_6 is exothermic, and the titration yields sharp, highly reproducible endpoints.

Keywords: aluminium, aluminum, thermometric endpoint titration, TET, analysis, titration, alum, polyaluminium, aluminate, bauxite.

Energy savings in alumina evaporation plant and purification of alumina spent liquor with salting-out

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Abstract

Energy price and bauxite quality are parameters that have changed in recent years. The rising costs of fossil fuels coupled with the necessity of tighter environmental protection laws have compelled the industry to reduce its carbon footprint in a period of alumina over-production. In addition, some alumina producers have had to rely on imports due to shortage of readily available good quality bauxite locally. The energy used in an alumina refinery can be split in three major areas: 25 to 30% for evaporation, 30% for digestion and 30-35% for calcination. Spent liquor concentration plants are typically multiple effects or multiflash evaporators with steam economy fixed during design phase and most likely on the basis of cheap energy, without consideration of a possible rise in cost. In coal producing region in China, energy is less sensitive to transportation costs and remains stable at 60 to 120 RMB/Ton. However, in recent years in eastern regions of the country, steam cost has jumped from 120 RMB/Ton to 200-250 RMB/Ton (+66-108%).

Revamping of existing evaporation plants with additional effects, use of mechanical vapour recompression (MVR) pre-concentration, coupling of digestion and evaporation with recovery of fatal steam or hot condensate stream are some key solutions to lower energy consumption. Other less obvious tools to boost productivity and save energy include the application of total productive maintenance (TPM), training and awareness, leakage control, replacement of inadequate pump sealing system and scaling minimization. Such investment not only maintains production costs under control, it also helps protect the environment and improve competitiveness.

As each plant is different, selecting the most appropriate technology is governed by technical feasibility and pay-back period.

To illustrate, let's consider a five effect evaporation plant with 200T/h capacity with a steam economy of 4. If applicable, adding another effect could bring an additional 0.5 points of steam economy : reducing the steam flow from 50 to 44.4 T/h. Based on a steam cost of 200 RMB/T and 8000h/annum operating time, this is a potential saving of 8.88 M RMB/annum (about 1.1 M€/annum).

There are fewer spots to mine high quality bauxite in China, leading producers to import bauxite. Reduction of transportation cost and independence on foreign supply could be obtained by using lower grade bauxite and adequate purification processes such as precipitation of Sodium Carbonate, Sulfate and Oxalate or burning of organics in spent liquor.

Effect of additive on enhancement of gibbsite yield in sodium aluminate solution

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Abstract

The gibbsite yield in Bayer precipitation process is low as compared to the available alumina in the solution. Various attempts were made elsewhere for enhancing the yield by adding different additives,

such as polymers, surfactants, inorganic and organic agents, or by activating the seed hydrate. But all these methods suffer from certain drawbacks; they either spoil the liquor or increase the energy consumption. In the present study attempt has been made to evaluate the effect of two different additives such as hydrazine hydrate and urea on decomposition of aluminate liquor under seeded condition. Different parameters such as alumina:caustic (A:C) ratio, temperature, time period of precipitation, concentrations, etc. were studied. Products were characterized using x-ray diffraction, scanning electron microscope, TG-DTA, FTIR, etc. The aluminium hydroxide precipitation in sodium aluminate liquor was improved substantially by the addition of hydrazine hydrate and urea. Lower quantities of hydrazine hydrate are beneficial for a good yield.

Addition of urea in to sodium aluminate solution substantially improved the precipitation ratio of aluminium hydroxide. In all the cases the aluminium hydroxide obtained at elevated temperatures showed gibbsitic nature. At higher temperatures urea decomposition rate is faster. SE Micrographs showed agglomerated particles in the case of hydrazine hydrate when added along with seed particles. The hydrazine hydrate probably is regenerated in the system when added in small quantities which seems to be more effective. In case of urea, the morphology showed globular type of precipitates consisting of agglomerates of hexagonal platelets showing typical gibbsitic morphology. TG analysis revealed about 34.6% wt. loss which is equivalent to gibbsite particles. DTA analysis showed an endothermic peak at $325^{O}C$ which is accompanied by escape of two water molecules from the gibbsitic matrix and therefore transforming to boehmite phase. A second endothermic peak was also observed at around $550^{O}C$, which is accompanied by complete removal of hydration water and transforming to chi alumina. The conceptual mechanisms of the precipitation process in the presence of hydrazine and urea were also proposed.

Production of Pig Iron and Portland Slag Cement from Red Mud by Application of Novel Thermal Plasma Technique

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Abstract

Red Mud of Indian origin contains around 50% plus of Fe_2O_3 depending on the source of bauxite and is considered as a hazardous waste for the Alumina Industry. For production of one tonne of Alumina employing the time tested Bayer's Process, around two tonnes of Red Mud is generated from three tonnes of Bauxite. No suitable avenues for bulk utilization of Red Mud have so far emerged.

In the present study, efforts have been made to produce pig iron from Red Mud produced by M/S Vedant Aluminium Ltd., Lanjigarh, Odisha, India by employing state- of -the -art Thermal Plasma Technique. In the process, Red Mud in the powder form is charged into the Thermal Plasma Furnace

at a temperature of 1600°C for a duration of 30 minutes. The pig iron thus produced, contains 93-95% Fe with recovery efficiency of 90% at optimized conditions. The residual slag produced in the process is utilised for manufacture of cement. The quality of cement so produced, matches well with the specification of standard Portland slag cement (PSC) presently in use in the constuction sectors. Thus the process can very well be considered as a zero waste process for production value added materials from Red Mud.

A Green Product for Improving Energy Efficiency in Bayer Process

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Abstract

Refining bauxite to produce alumina is a highly energy intensive process. Due to the existence of silica in bauxite the formation of scale, especially sodalite (Sodium aluminosilicate) in heat exchangers and evaporators is inevitable. This scale formation is a major cause of heat loss in Bayer plants. To mitigate this problem we have designed and developed a series of highly effective polymer-based inhibitors (MAX HT™) to prevent the formation of scale. This proven technology has won a US Presidential Green Chemistry Challenge Award for Cytec in 2012. In this paper we will discuss how these reagents work to stop the formation of scale in Bayer liquor. Examples of alumina plants that have successfully applied these reagents to inhibit the formation of scales in their digesters and evaporators will also be provided. Tremendous savings in steam usage and much improved process stability without any negative downstream effects have been realized.

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Preparation of Titanium Carbide from Titanium Oxide recovered from Undigested Sand of an Indian Alumina Refinery through physical beneficiation

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Abstract

Alumina is produced from khondalite hosted bauxite of Indian origin in the Alumina refinery employing the time tested Bayer's Process. When 2.4 MT of bauxite per annum is processed in a refinery, it produces approximately 0.8 MT of alumina. During the process of alumina production, about 60% of unwanted gangue is rejected as 'undigested sand' and 'Red Mud'. Out of total quantity

of 70 Million tonnes per year (Mtpy) of red mud in the world, India accounts for about 2 Mtpy. This industrial waste material poses tremendous environmental and disposal problems. With the anticipated expansion of alumina Industry in the country, Indian alumina plants have to dispose of over 5 Mt of this red mud every year.

Aluminium Oxide constitutes 38 to 60% of bauxite ore. The rest is made up of Fe_2O_3, SiO_2, TiO_2 and other metallic oxides. After dissolution of alumina in caustic soda, these impurities remain in suspended form which is separated out as undigested sand and subsequently as red mud. Out of these metal oxides, around 8 to 25% of Titanium Oxide is lost in to this waste. Titanium Oxide is invariably present as rutile and ilmenite in the undigested sand. This Titanium Oxide phases were processed through cost effective beneficiation technique. A concentrate containing 38% TiO_2 with 47.30% recovery was obtained.

This paper while enlisting the extent of various metal values disposed as rejects (undigested sand and red mud), describes the detailed beneficiation technique to recover Titanium value from undigested sand and discusses the processing of Ti-rich concentrate to smelting with activated carbon in an extended arc plasma reactor and production of Fe-TiC composite as a fused mass within 5 minutes. After grinding and leaching, TiC powder was obtained and it was found to be comparable with the commercial grade Titanium Carbide.

Keyword: Bauxite, Alumina Refinery Rejects, Undigested Sand, TiO2 -Beneficiation, TiC

Rapid Determination of Caustic and Alumina in Bayer Solution with Titrotherm

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Abstract

Analysis of the recirculating aluminate solutions is the single most important analytical task in the control of the Bayer Process. Accurate and precise knowledge of the total hydroxyl (“caustic”) and alumina values is required to maintain the highest process productivity. Conventional manual titration method requires extensive training of operators with elaborate procedures for counter checking of results. Titrotherm titration is a kind of method that evaluating titration end point according to chemical reaction temperature changes. Fast and accurate analysis of Bayer process solution can be achieved with Titrotherm.

Keywords：Bayer solution, Titrotherm, alumina, caustic

Comprehensive Utilization of Nepheline Resources

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Abstract

The present paper gives the brief introduction on current world nepheline resources and utilization conditions, and makes analysis and comparison on traditional nepheline production process of China and abroad and put forwards some kinds of new processes. Based on analysis on these processes, suggestions are made for selection of appropriate nepheline production process and brief introduction of various procedures such as sintering, digestion, medium-pressure desilication, deep desilication, hybrid decomposition, carbonation etc., and at last makes analysis on economic benefits of comprehensive nepheline resources utilization by combining China nepheline resources conditions.
Keywords: Nepheline; potassium carbonate; sodium carbonate; cement; alumina; silica modulus; carbonation; sintering; digestion; medium-pressure desilication; deep desilication; hybrid decomposition

Comprehensive Recycling for Waste Heats of Aluminum Hydroxide Calciner

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Abstract

In the aluminium hydroxide fluidized calciner system, the waste heats taken away by the calcinations product (alumina) and fume account for over 35% thermal consumption of the whole system, so the recycling and re-using for these two parts can reduce largely the energy consumption of the whole calciner system to reach the energy-saving & consumption –reduction targets. By heat exchange between fresh water and high temperature alumina materials after calcination, the heated fresh water is sent to the alumina production system for re-use to save steam consumption; one new-type spray fume adsorption device can collect the high temperature fume, and heat the fresh water by heat exchange between the collected high temperature water and fresh water, at last the heated fresh water is sent to the alumina production system for re-use, which can save steam consumption largely.
Keywords: waste heats recycling, aluminium hydroxide, fluidized calciner, energy saving

Research on the suitable Resin for Recovery of Gallium from high Vanadium Mother Liquor of an Indian Alumina Refinery

Xu Shutao, Zhou Jiangzhu

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Abstract

Indian Belgaum Alumina Refinery of HINDALCO, having capacity of 380kt/annum alumina with 70% special alumina and 30% being metallurgical alumina, process gibbsitic bauxite by adopting low-

temperature Bayer process. The Liquor has relatively higher V_2O_5 content of about 2~1.5g/l, which has relatively bigger influence on the resin Ga recovery process, so the traditional basic and acidic resins in Chinese resin Ga recovery technology cannot be used in India high-vanadium mother Liquor Environment. By test & comparisons on various resins and process options in Indian site, it is confirmed that the LC-600 special resin is suitable for the resin Ga recovery technology in India High-vanadium mother Liquor Environment.

Keywords: High-vanadium mother Liquor Environment, resin method, basic resin method, acidic resin method, special chelating resin

For efficient utilization of the alumina in the aluminium smelter the nature of the fine particles, rather than the quantity, is also of high importance. Outotec's CFB calcination technology results in a uniform product quality with low alpha alumina content and only traces of residual gibbsite.

ABSTRACTS

CHALIECO, ANTAIKE & IBAAS

SECTION II

ALUMINIUM ELECTROLYSIS

Retrofit of electrolysis cells with the Coperion DURODENSE Alumina pot feeding system

Betram Bartsch,
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Abstract

Coperion – the specialist for bulk material handling systems in the aluminium industry – resents its experience with the retrofit of electrolysis cells with the automatically operating DURODENSE ® alumina pot feeding technology. The DURODENSE® system is built of a modular system body consequently using round shaped standard piping with internal fluidization elements for the most gentle product transport. Due to such slim design the routing of the system is very flexible and as a consequence the installation at and the penetration through an existing pot room wall structure is eased. This makes the system very interesting for retrofit and optimization projects in existing smelters. During the session the main characteristics of the DURODENSE® system and the operation experience will be shown.

Logistic concepts for the handling of higher quantities of Alumina/Petcoke from overseas

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Abstract

Coperion – the specialist for bulk material handling systems in the aluminium industry – presents its experience/concepts of material handling systems to unload Alumina from vessels with Coperion vacuum ship unloaders and the necessary Coperion equipment to convey the material from the vacuum ship unloader to the storage silo including truck/rail car loading.
Coperion has the following experience/ design on the above mentioned products:
- Vacuum ship unloaders up to 1.000 t/h; Ship loaders up to 1.200 t/h
- Silos up to 70.000 m^3
- Multiple point feeding for large silos to avoid the segregation of the Alumina
- Airlift up to 500 t/h
- Mechanical conveying system (up to 2.200 t/h)

The handling of Alumina/Petcoke becomes a more and more important aspect in the supply chain of an Aluminum smelter. Depending on the smelter location Alumina/Petcoke has to be imported with bulk ships and a specific logistic concept is required to handle the high quantity of bulk material. During the session the specific function of the Coperion vacuum ship unloader and the concept/design of the material handling and storage equipment will be shown.

Low Temperature Aluminium Carbothermic Smelting Process

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Abstract

The Aluminium industry is facing increasing issues as it seeks to achieve process improvements to reduce the current high production cost and significant environmental problems that it faces, particularly in its smelting process. Currently well over half of all electrochemical smelters producing aluminium around the world are in a loss making position.

Therefore the industry's challenges include the need for significant process and technology change. Historically, Aluminium pyrometallurgical smelting technology has been proposed for the required radical step changes, including a significant aluminium product cost reduction, however, attempts to commercialize carbothermic smelting technology for aluminium have not been successful to date.

Recently, Calsmelt completed a "concept proof" for its ThermicalTM carbothermic smelting process. Based on this new carbothermic approach, aluminium has been produced from alumina at temperatures about 400°C lower than those of previous attempts. In addition to the production of primary aluminium, the process is capable of producing clean recycled aluminium. The process has been developed to the pilot stage and a plan to construct and test a significant pilot plant has been developed. Using appropriate options in this process, reduced electric power consumption, GWP (CO2eq), and lower carbon consumption, each between 40% and 75% can be achieved, when compared to the best practice operations of the current Hall-Heroult process (both using coal-based electricity). Based on the Thermical™ process, primary aluminium smelting plants with a breakeven point as low as 15,000 tonne/year and with aluminium produced at around half the cost of the present Hall-Heroult process can become a reality.

Keywords: Carbothermic, Aluminium, Smelting, Low Temperature, Energy, Environment

Effect of undissolved alumina on metal pad instabilities in aluminium smelting

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Abstract

Present day aluminium smelters rely on sophisticated designs and operating strategies for reducing overall operating costs and increasing productivity. The technological advances are related to

improved alumina feeding, magnetic field compensation in the metal pad, reduced cell operating temperatures and dry scrubbing emissions using alumina. In spite of all these advances, there is still the problem of "sludge" formation resulting from incomplete dissolution of alumina in the bath with consequent adverse effects on current efficiency and power consumption. As sludge formation is related to the performance of the cell operation, the understanding of the frequencies of metal instabilities caused by undissolved alumina and, conversely, of how sludge formation can be prevented is important. These studies can lead to better cell performance through optimized cell voltage and power consumption. Magnetic field, current distribution, heat loss and voltage at zero current measurements along with online current and voltage signal can help in identifying the problems and their combined effects on the performance of the cells.

In order to estimate the loss in current efficiency of the aluminum electrolysis cells due to sludge formation leading to metal instabilities, measurements were performed and data analyzed. The present paper analyses the frequency of metal instabilities caused due to effect of sludge formation and its effect on current efficiency of the cell. Measurements carried out to estimate the deviations from the normal cell operations are also discussed.

Key words: Aluminium, sludge, magnetic field, cell voltage, instability, noise

Production Systems and MES to Optimize Operation in Primary Aluminum Smelters

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Abstract

Construction of modern smelter is a complex endeavour, technically and organizationally. Shareholders are expecting quick ROI and full optimization of the capital invested during the project. When fully commissioned, new and especially old plants are facing significant operating cost pressures. One key approach used to manage this pressure are automation, process control and production systems to optimize plant processes, manage quality, prevent equipment damages, stream line maintenance data flows and focus on problems anticipation. On the other hand, the challenge smelters are facing is to ensure the right integration and business alignment of these systems, still be user-friendly and with low TCO (total cost of ownership). This presentation will explain what a MES system is (Manufacturing Execution Systems), its main functionality and how it can help to reduce OPEX (operating expenditures) in a smelter.

Keywords: Automation, Integration, Smelter, Commissioning, Process Control, MES

Liquidus temperature detection with embedded system by locating algorithms for turning points

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Abstract

This paper advances a method for quick effective locating turning points by discrete point set of plane curve and then combines the method with step cooling algorithm to calculate liquidus temperature point of discrete data using non-fitting curve way. And then describes an on-line liquidus temperature detection system based on embedded processor EP9315. Finally presents real snapshots on-site about how embedded system to capture and identify varied liquidus temperature plateaus by crucible even under the environment of high temperature and powerful electromagnetic fields.

Keywords: Liquidus temperature; embedded system; turning point; step cooling algorithm; on-line

160KA 新型阴极结构电解槽

160KA Pot with New Anode Structure

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Abstract

Reduced energy consumption and hence lower power costs is one way of tackling the problems faced by the aluminum industry. The introduction of a 160KA pot with a new kind of anode structure, not only keeps the low running voltage of drained pot, but also solves some problems such as the ledges generated at the pot corner. In this way the energy consumption can be reduced greatly during production.

Key words: Drained pot, collector bar, current distribution, DC consumption

160KA 电解槽添加锂盐试验研究

Research on Test of Lithium Salt Addition to 160KA Reduction Cell

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摘要

在电解槽上采用添加锂盐的方法，提高电解质中的锂含量，提高电解质的导电率，降低电解槽平均电压，提高电解槽的电流效率，最终降低电解槽电耗。

Abstracts

The lithium salt is added to the reduction cell, so as to increase the lithium content in the bath and the conductivity of bath, reduce the average voltage of cell, improve the CE of cell and finally reduce the power consumption.

关键词：锂含量 电解质温度 导电率 电流效率

Keyword: lithium content, bath temperature, conductivity, CE

170KA 铝电解槽节能生产实践

Production Practice on 170KA Energy-saving Reduction Cell

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摘 要

本文介绍了中国铝业广西分公司电解铝厂 170KA 系列铝电解槽节能生产工作实践经验。通过升级电解槽控制系统，打磨阳极导杆，对阳极开沟，推广磷生铁浇注阴极钢棒、“201”项目电解槽，对电解槽进行保温等途径，达到节约能源，降低成本。

Abstracts

Production practice experiences on energy-saving of 170KA reduction cell in Guangxi Branch of Chalco are introduced. With polishing the rod, slotting the anode, promoting the collector bar with iron casting and the reduction cell of “201” project and preserving the heat of reduction cell, the energy-saving and the cost-reduction are achieved.

关键词：铝电解 节能 电耗 密封 保温

Key words: reduction cell, energy-saving, power consumption, sealing, heat preservation

浅谈提高电解槽密封效果的方法

Methods to Improve Cell Sealing Effect

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摘要

本文简要描述了电解槽缝隙的种类、面积、产生的原因，针对各种缝隙采取的密封措施及取得的经济效益。

Abstract

The essay describes briefly type, area and formation reasons of cell seams, sealing measures for various seams and the obtained economic benefits.

关键词：电解槽缝隙；密封；效益

Keywords: cell seam, sealing, benefit

浅谈铝电解生产技术管理

Brief Discuss on Aluminium Electrolysis Production Technology Management

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摘要

本文浅谈铝电解生产技术管理。指出随着科学技术的不断发展及人们环保意识的不断加强，在铝电解生产中，不发生病槽是铝电解技术管理的更高境界。同时，公司开展的运营转型工作为我们提供了多种分析问题和解决问题的方法。

Abstract

This paper discusses the aluminium electrolysis production technology management briefly. As the continuous development of science and technology and the continuous enhancement of people's environmental awareness, the higher level of aluminium electrolysis production technology

management is required, i.e. no ill reduction cells. Meanwhile, the operational transformation launched in our company has just supplied us various methods to analyse and solve problems.

关键词：技术参数　病槽

Key Words: Technical Parameters, Sick Pot

低电压运行的生产实践

Production Practice on Low Voltage Running Cell

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摘要

本文叙述中铝某分公司 175KA 系列电解槽降低电压过程和低电压运行出现的问题，并通过优化电压，优化技术条件组合，达到系列电解槽运行平稳，提高电流效率，降低电耗的效果。

Abstracts

Some problems happening during low voltage running of 175KA cell in some branch of Chalco are presented. With optimization voltage and technical conditions group, the smooth running of cell is achieved, so as to increase CE and reduce the power consumption.

关键词：电压　电流效率　直流电耗

Keywords: voltage, CE, DC consumption

换极后长时间高电压的原因分析及影响

Analysis on Causes and Influences of Long-term High Voltage after Anode Change

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摘要

本文对更换阳极后部分电解槽产生长时间的高附加电压的原因及导致的不利影响进行简要分

析，主要就换极过程中扒极上浮料及打捞落入槽内的块料工作对电解槽氧化铝浓度变化，是导致电压波动较大且高，甚至会破坏电解槽的平稳运行主要因素。所以规范操作行为，切实执行标准化操作，减少对电解槽的干扰，使电解槽生产时刻处于平健康.稳定.有序.高效状态，最终对达致节能降耗的目的有着积极的意义。

Abstract

The causes of the long-term high voltage in reduction cell after anode change and corresponding adverse influences are briefly analysed in this paper. If the loose material on anodes and the blocked slags falling down to reduction cell are not skimmed/removed completely, the alumina concentration in reduction cell will change, this is the main factor to cause high voltage with great fluctuation, and even destroy the stable running of reduction cell. Therefore, standardized operation is actually required to reduce disturbance on reduction cell, maintain reduction cell under healthy, stable, orderly and high-efficient status, and finally achieve purpose of energy-saving and consumption decreasing.

关键词：更换阳极　氧化铝浓度　电压

Key Words: Anode Change, Alumina Concentration, Voltage

铝电解槽焙烧启动对寿命的影响及对策

Influences of Baking Startup on Reduction Cell Life & Countermeasures

黄为灼

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摘要

本文列举了铝电解槽破损的特征，分析影响铝电解槽寿命的主要因素是电解槽的设计、电解槽内衬材料的选择、筑炉质量、电解槽的焙烧启动和电解槽的工艺技术管理五方面，并重点论述焙烧启动对槽寿命的影响和通过对电解槽焙烧启动的精细管理与操作，可达到延长电解槽寿命的目的。

Abstract

In this paper, the damage characteristics of reduction cell are listed, the five main factors of cell design, lining materials, lining quality, baking startup and process technology management, which influence reduction cell life, are analysed, and the influences of baking startup on reduction cell life are

emphasized. It's stated that accurate management and operation during reduction cell baking startup is a practical way to prolong the life of reduction cell.

关键词：电解槽寿命 焙烧启动 阳极效应 电解质 铝液 工艺技术

Key Words: Reduction Cell Life, Baking Startup, Anode Effect, Bath, Metal, Process Technology

提高铝电解生产控制系统稳定性的探讨与实践

Discussion and Practices of Stability Improvement on Aluminum Reduction Process Control System

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摘 要

从我厂 160kA 系列铝电解槽控制系统近几年来的生产控制实践中进行探索、分析总结，找出影响控制系统稳定性的主要原因，对影响控制系统的关键因素进行了研究和实践，并提出了解决的方案和措施，经过改造取得良好的效果，进一步提高系统的稳定性和安全性，并且可以应用到目前大型铝电解生产控制系统中。

Abstracts

the essay finds the main causes to influence control system stability by analysis and summary on 160kA cell control system practices of Guangxi B ranch in recent years, and puts up the solutions for them. By reforming, the good effect is reached, and the system stability and safety are improved further. The solutions can be promoted to the high amperage aluminum reduction control system.

关键词：槽控机； 控制系统； 光纤通讯； 稳定性； 防雷； 磁场

Keywords: pot controller, control system, fiber communication, stability, lightning protection, magnetic field

浅谈现场操作对电压的影响

Discussion on Impact of Site Operation on Voltage

覃当

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摘要

铝电解生产要求现场所有的操作规范有序，尽可能减少干扰，目的是避免系统对电解槽的误判，从而让电解槽处于健康，稳定，有序，高效低耗的工作状态。以下就换极工作和处理下料点堵卡对电压的影响，说说我个人的看法。

Abstracts

the aluminum reduction production requires all the site operations must be standard and orderly with less disturbing as far as possible to avoid system misjudge on cell, thus to keep the cell healthy, stable, orderly high-efficient and low-consumed. The essay discusses impacts of anode change and feeding point blockage treatment on voltage.

关键词：换极、扒料、氧化铝浓度、过欠、附加电压、沉淀、炉底压降

Keywords: anode change, skimming, alumina concentration, over/under and additional voltage, precipitation, voltage drop of cell bottom

160kA 电解槽降低阳极效应分摊电压浅谈

Discussion on Reduction of AE Shared Voltage of 160KA Reduction Cell

汤 伟

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摘 要

本文分析了在实际生产中影响阳极效应分摊电压的几个主要原因，并总结了针对原因工厂采取的实际可行的措施。重点阐述通过优化技术参数组合、改造打壳下料设备来加强对效应的控制，降低效应系数，进而降低阳极效应分摊电压，从而达到节能降耗的目的。

Abstracts

Main reasons affecting AE shared voltage in actual production are analyzed, and the feasible measures for the plant are summarized. The AE is controlled with optimizing the technical parameters group and renovating the breaker to reduce the AE coefficient, so as to reduce the AE shared voltage, with the purpose of energy-saving.

关键词：效应分摊电压；效应系数；效应电压；效应持续时间；技术参数

Keywords: AE shared voltage, AE coefficient, AE voltage, AE duration, technical parameters

浅析电解多功能机组绝缘监测控制系统

Analysis on Insulated Monitoring Control System of PTM

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摘要

本文主要阐述电解多功能机组绝缘监测控制系统在大型预焙电解槽生产过程的重要性；浅析绝缘监测控制系统布局、应用及其常见故障处理，并提出在日常维护检修方面的几点建议。

Abstracts

The importance on the insulated monitoring control system of PTM during the production of large prebaked pot is put forward; the layout, application and fault treatment of insulated monitoring control system are analyzed; and the suggestions for daily maintenance are presented.

关键词：电解多功能机组 绝缘监测 控制

Key words: PTM, Insulated monitoring, Control

大型电解槽预焙阳极技术的发展方向

Development Direction of High-amperage Pot Prebaked Anode Technology

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摘要

铝电解技术正朝大型化节能减排方向发展，对预焙阳极技术提出新的要求。本文对预焙阳极的结构优化提出新方法，以满足大型电解槽降低 ACD 节能，减少 AE 发生，为收集阳极气体提供条件，解决电解铝温室气体排放问题。支撑铝工业可持续发展。

Abstracts

The aluminum reduction technology is developing at the large-scale, energy-saving and discharge-reduction, which puts up the higher requirements on the pre-baked anode technology. The essay gives new method for pre-baked anode structure optimization to decrease ACD for energy-saving, reducing AE, creating conditions for anode gas collection and solving greenhouse gas emission of aluminum reduction process for sustainable development of the aluminum industry.

关键词:大型电解槽 预焙阳极 结构优化 降低极距 减少阳极效应 收集阳极气体

Keywords: high-amperage pot, pre-baked anode, structure optimization, ACD decrease, AE reduction, anode gas collection

电解铝阴极综合节能技术分析

Energy Savings in Cathode used for Aluminium Electrolysis

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摘要

阴极是铝电解槽的核心，阴极原材料和组装质量的优劣，直接影响电解槽寿命和电解能耗，同时对铝电解过程中的经济指标测算和技术指标调整起到了关键性的作用。本文针对阴极炭块、阴极钢棒、钢棒糊等材质、性能的改变在电解槽综合节能技术中的作用，分析了阴极块组装质量对电解槽经济技术指标的影响，并为电解槽阴极方面材料的选择，工艺的改进及质量保障等提出了可行的技术手段。

Abstract

Cathode is the core of electrolysis cells. The quality of cathodic raw materials and installation would influence the cells' power consumption and service life directly; meanwhile, it plays a critical rule in the economic indicators calculation and technical parameters adjustments during cells' operation.

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According to the influences from the material and performance changes of cathodic carbon blocks, cathodic steel bar and ramming paste on integrated energy-saving technique of aluminium cells', this paper analyzes the influences of installation quality on cells' economic and technical indicators, and it also puts up with practical technique methods about the cathodic materials options, process improvement and quality guarantee and so on.

关键词：铝电解槽；阴极炭块；阴极钢棒；钢棒糊；炉底压降；水平电流；炉膛；节能。

Keywords: aluminium electrolysis cells, cathodic carbon blocks, cathodic steel bar, ramming paste, bottom voltage drop, horizontal current, furnace, energy-saving.

电解槽高温烟气焙烧技术研究与应用

Research and Applications of High Temperature Gas Baking Technology in China

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摘要

近年来我国高温烟气焙烧技术发展日趋成熟，并在国内多个电解铝企业开始大规模工业应用。本文针对电解槽高温烟气焙烧启动技术的研究和应用实践，总结了相关核心问题的研究结果和应用效果。高温烟气焙烧技术较传统的焦粒焙烧方法和燃气焙烧技术，具有控制精确、焙烧效果优越、温度均匀、操作方便等突出特点，可应用于各种类型的新槽焙烧启动以及事故槽二次焙烧启动。

Abstract

At present, fuel gas technology is becoming mature in recent years, which has been applied in many domestic electrolytic aluminum enterprises on a large scale. This paper summarizes fuel gas baking technology features during every stage, in consideration of its development progress. Compared with coke particle baking method and overseas fuel gas baking technology, this widely used high temperature flue gas technology today has many prominent features such as accurate control, excellent baking effects, easy operation and so on. Applicable to the baking startup of new aluminum cells,

overall-maintenance cells and second startup cells, this technology could work with various types of fuel and bring about remarkable social and economic effects.

关键词：烟气焙烧；电解槽；控制；防氧化；焙烧启动；二次启动

Key words: flue gas baking, electrolytic cells, control, anti-oxidation, baking startup, second startup.

电解铝固体废物回收利用技术进展

Technical Advance of Electrolytic Aluminum Solid Waste Recycling

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摘要

随着原材料和能源价格的上涨，电解铝的盈利空间越来越小、生存压力越来越大，约 93%的电解铝企业处于亏损状态，降本增效显得尤为重要。电解铝排出的固体废物（诸如阳极碳渣、废阴极块、软残极）含有较大比例的高附加值氟化盐，具有较高的回收利用价值。本文介绍了电解铝固体废物的回收利用现状，分析了几种技术的经济可行性。

Abstract

Long with rise in prices of raw materials and energy, profit margins of electrolytic aluminum continue to compress, and the industry has to face more and more compressive stress, approximately 93% of electrolytic aluminum enterprises have slid into loss, it thus appears that cost decreasing and benefit increasing is particularly important. Solid wastes exhausted from smelter (such as anode coke, waste cathode block, flexible butts) contain a large proportion of high value added fluoride salt, providing comparatively high recycling value. The article introduces the recycling status of electrolytic aluminum solid wastes, and analyzes economic feasibility of several technologies.

关键词：电解铝 固体废物 回收利用 氟化盐 阳极碳渣

Key words: Electrolytic aluminum, solid waste， recycling, fluoride salt, anode coke

240kA 铝电解槽内衬结构优化

Lining Structure Optimization for 240kA Aluminium Reduction Cell

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项目来源：国家低碳技术创新及产业化专项（文号：国家发改办高技[2011]1046 号）

摘要

本文以 240kA 铝电解槽内衬结构优化为突破口，开发一种新型节能阴极结构电解槽。通过新型内衬结构电热场仿真计算，在低电压下能够提高电解槽的稳定性，解决了普通内衬电解槽在低电压下运行时存在的一些问题，实现了电解槽在低电压下稳定运行，达到了铝电解槽高效节能的目的。

Abstract

A new type of aluminium reduction cell with energy －saving cathode structure was developed based on the cathode structure optimization for 240kA cell.By a simulating calculation of thermo-electric field for the new lining structure,the stability of the cell was increased under low voltage,and some problems exsiting in common lining cell were solved ,stable running of the cel was achieved and the goal of energy-efficient was reached.

关键词：铝电解；内衬结构优化；高导电性阴极钢棒；冷捣糊；高效节能

Keywords： aluminium electrolysis, lining structure optimization, high conductivity cathode bar, cold ramming paste, energy-efficient

提高 PLC 自动控制系统稳定性的探讨

Study of PLC Automation Control System Stability Improvent

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摘要

本文简要介绍了 PLC 自动控制系统及其稳定性对经济运行和工业生产安全的影响,在如今 PLC 应用场合越来越广，应用环境越来越复杂的形式下，系统所受到的干扰也越来越多，因此如何提高系统的抗干扰能力是整个系统稳定运行的关键所在。通过对 PLC 自动控制系统干扰源的研究分析, 认为一般干扰源主要分为：共模干扰和差模干扰；干扰源主要来源包括：PLC 系统外部干扰、PLC 系统内部干扰以及空间辐射干扰等，分析其在控制系统中的影响, 针对不同干扰源，提出了几种不同的抗干扰的措施,即电源部位拦截、稳定的传送系统及合理的接地系统、提高执行机构等外部设备的抗干扰能力、完善合理的故障报警系统等，分析了提高 PLC 稳定性的方法及 PLC 应用领域的发展趋势。

Abstract

This paper briefly introduces the PLC automatic control system, its stability on economic performance and safety impacts of industrial production. At present PLC applications more widely and its application environment has become increasingly complex, systems has more and more interference, so how to improve the anti-jamming capability is the key to stable operation of the whole system. Analyzes the interference of PLC system, that the source of interference is mainly divided into Common mode interference & Differential mode interference. Major sources of interference sources: PLC external interference、PLC internal interference and Space Radiation. Analyze the influence of the control system, for different sources of interference proposed different measures, scilicet power parts intercept、stable delivery system and a reasonable grounding system、implementing agencies and other external devices to improve anti-jamming capability、sound and rational fault alarm system. Analysis of method to improve the stability of the PLC and PLC application in the field of development trend.

关键词：PLC自动控制系统；PLC系统稳定性；干扰源；共模干扰和差模干扰；抗干扰措施；PLC发展趋势

Key words: PLC automatic control system; the stability of PLC; interference source; Common mode interference & differential mode interference; Anti-jamming measures; development tendency of PLC

炭素材料直接石墨化技术的发展

Development of Direct Graphitization Technologies of Carbonaceous Materials

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摘要

本文介绍了炭素原材料直接石墨化技术的发展。其中，重点阐述了以石油焦、无烟煤为原料，使用高温石墨化电煅炉进行连续石墨化生产工艺所生产人造石墨具有低硫、低比电阻、高石墨化度。此技术及设备已成功实现产业化并实现工业化生产，为实现人造石墨、石墨化煤的大规模工业化生产提供了可靠的技术设备保证。

Abstract

This article describes the development of direct graphitization technologies of carbonaceous raw materials. In particular, the article primarily elaborates that artificial graphite, which is produced by virtue of the continuous graphitization production process with petroleum coke and anthracite as raw materials and high temperature graphitization electrical calciner as production tool, has the features of low sulfur content, low specific resistance and high graphitization degree. This technology and equipment, which have successfully achieved industrialization and industrial production, provide a reliable guarantee for mass industrial production of artificial graphite and graphitized coal.

关键词：人造石墨、高温电煅炉、脱硫、增碳剂

Keywords: Artificial Graphite, High Temperature Electrical Calciner, Desulfurization, Carburetant

浅谈铝电解槽全电流焊接降磁技术在槽大修中的应用

Application of Technology of Magnetic Induction Intensity Weaken in the Condition of Pot Line Current on Overhauling of Aluminum Reduction Cells

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摘要

由于受强磁场的影响，铝电解槽在全电流下无法焊接。本文提出了一种在全电流下降低铝电解槽阴极钢棒 - 母线软带、母线—母线施焊区域磁场的技术。该技术已在350kA、230kA、200kA 铝电解系列应用，可实现将施焊区域磁感应强度由 100～300 Gauss 降低到 50 Gauss 以下。应用该技术与装备进行焊接后的焊接压降小于 10 mV。

Abstract

Because of the powerful magnetic fields, the position just like between collector bar and flex or among the bus bars can not be welded. A kind of technology which is used for weakening magnetic field of welding position just like between collector bar and flex or among the bus bars of aluminum reduction cells in the condition of pot line current was presented. The technology has been applied on 350kA、230kA、200kA pot line, the magnetic field of welding position can be weakened from 100～300 Gauss to less than 50 Gauss, the welding voltage drop is less than 10.0 mV.

关键词：铝电解；焊接；焊接压降；磁感应强度

Keywords: aluminum electrolysis, welding, welding voltage drop, magnetic induction intensity

关于电解铝厂经济规模的探讨

Discussion on the Economics Scale of Aluminum Plant

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摘要

本文通过从电解槽槽型选择，大型槽稳定性研究,槽型选择与单个系列年产能的关系,电解槽的寿命讨论与总结, 来探讨电解车间的经济规模, 并得出初步的结论与建议。

Abstract

This article through select appropriate pot scale, research the stability of the large pot scale, and the relation between the pot scale selecting and the annual capacity of the single series, about the pot life

discussion and summarize, to explore the economics scale of the plant, and draw preliminary conclusions and recommendations.

关键词： 铝电解槽；经济规模；槽寿命

Keywords: aluminum pot, economics scale, pot life

铝电解技术发展及展望

Development & Prospects on Aluminum Electrolysis Design & Production Technology

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摘要

本文分析了电解槽槽型选择与槽稳定性、单个系列年产能的关系，讨论与总结了槽型对电解槽寿命的影响，探讨了电解车间的合适的经济规模，并得出初步的结论与建议。结合国际铝电解行业的发展情况，提出了高阳极电流密度电解槽是我国未来电解铝发展的必然趋势，也是提高我国大型预焙电解槽技术在国际上竞争力的必然选择。本文还简单介绍了 GAMI 近年来研发的铝灰和炭渣综合利用技术、电解槽多物理场耦合仿真技术、磷生铁浇注阴极技术，这些技术为铝电解槽槽电压的降低、电流效率的提高提供了有力的技术保障，是未来铝电解发展的方向。

Abstract

The relation between pot capacity and stability is analysis in this article, as well as the relation between pot capacity and the annual capacity. Considering the international developing trend of aluminum, the high anode current density cell is inevitable choice to increase our competitive strength in the world. Coupling physical field and bath component are also introduced in the paper, as well as pig iron pouring cathode. Low pot voltage and high current efficiency are supported by all of these technical.

关键词：铝电解槽；槽容量；铝灰与炭渣综合利用；电解质成分；多物理场耦合；磷生铁浇注阴极

Key words: Aluminum Pot, Pot Capacity, Multi-purpose utilization, Bath component, Coupling physical field

铝电解槽低温烟气余热回收综合利用技术研究

Research on Waste Heat Recovery and Comprehensive Application Technology of Low-temperature Gas from Aluminum Reduction Cell

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摘要

铝电解是高耗能产业，回收利用铝电解槽排放的低温烟气余热，对铝电解行业节能降耗具有重大的意义。针对当前铝电解槽低温烟气余热回收利用率较低，开发适合铝电解工艺特点的低温余热回收技术，拓展低温余热利用途径是当前铝电解行业节能减排工作中亟待解决的问题。本文介绍了铝电解槽低温余热回收及综合利用过程中存在的难点，对铝电解槽 DRS 低温烟气余热回收技术和综合利用技术进行了阐述和应用综述，并通过应用实例介绍，说明利用铝电解槽 DRS 低温烟气余热回收技术和配套的综合利用技术对铝电解槽低温烟气进行余热回收利用，可提高余热的回收利用效率，产生明显的社会经济效益，在铝电解行业具有较高的推广价值。

Abstract

As the high energy consumption industry, the recovery and reusing on low-temperature fume waste heat of aluminum reduction cell is very important for energy –saving consumption-reduction of aluminum reduction industry. Due to the low recovery rate on the waste heat of cell fume, the key in the energy –saving consumption-reduction work of aluminum reduction industry is currently to develop the low-temperature waste heat recovery technology suitable to the aluminum reduction process features and find more reusing methods. The essay introduces the difficulties in the aluminum

reduction cell low-temperature fume waste heat recovery and comprehensive application technology, and , and describes the aluminum reduction cell DRS low-temperature fume waste heat recovery and comprehensive application technology, and by real example, indicates the method can improve the waste heat recovery rate with the obvious social economic benefits, which has good promotion values in the aluminum induction industry.

关键词：铝电解槽；低温余热；余热回收；制冷；ORC 发电技术

Key words: Aluminum reduction cell, Low-temperature waste heat, Waste heat recovery, Refrigeration, ORC generation technology

铝电解槽操作管理对电解生产运行的影响

Discussion about Influence of Pot Airproof on Electrolyte Process

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摘要

本文简略分析了电解槽操作运行过程中导致密封不良的原因，并通过现场测试数据及简略计算，阐述了强化电解槽运行过程中的操作管理不仅有利于促进环境保护，而且可以使电解系列节能 3~5%，降低氟化盐消耗 5~10kg/t-Al，降低电解烟气净化系统能耗 25%，大大降低了生产成本，实现铝电解生产节能、减排、降耗的目标。

Abstracts

By site data testing and simple calculation, this article expounds that reinforcing the pot airproof not only is in favor of environment protection, but also realizes 3~5% energy saving of the potline, reduces fluorides consumption by 5~10kg/t-Al and pot fume treatment plant energy consumption by 25%, which reduces production cost greatly and achieves energy saving, emissions reduction and consumption reduction targets of the pot production.

关键词：密闭，烟气量，能耗，氟化盐

Key words: Airproof， Fume volume, Power Consumption, Fluorides

电解槽节能技术的深度剖析电解槽节能技术的深度剖析

In-Depth Analysis on Energy-Saving Technology for Pots

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摘要

铝电解槽节能的基本原理就是降低电解槽运行电压和提高电流效率。一般状态下获得较低电解槽电压的方法是通过电解槽母线优化配置获得小于 5Gs 的 Bz 平均值，但是研究发现，在采取通用母线配置方法获得小于 5Gs 的 Bz 平均值的条件下，电解槽的磁流体流速却较快，难以达到高效率指标。在流速满足设计要求的条件下，Bz 的平均值又不能满足小于 5Gs 的技术条件。本文深度剖析直流电耗达到 12000kwh/t.Al 以下所采取的更进一步提高电解槽稳定性——抑制铝液层水平电流、曲面阴极降低流速、槽内衬保温匹配低电压等节能技术以及提高电流效率——氧化铝质量、电解质成分控制的关键技术问题。并对电解槽深度节能问题进行分析和探讨。

Absract

The fundamental principles for pots' energy saving lie in reducing the operating voltage and improving the current efficiency. In general case, the method to reach low voltage is to obtain the average value of Bz less than 5Gs by means of updated bus design; but the study shows under the condition the magnetic fluid flow rate is fast which is difficult to achieve the efficient indicators. When the flow rate meets the requirement of engineering, the average value can't satisfy the technical condition of being less than 5Gs. Supposing the direct current power consumption is below 12000kwh/t.Al, the article gives in-depth analysis on energy saving technologies, such as further improvement of pot stability, suppression of horizontal current of molten aluminum level, reducing flow rate of curved cathode, heat preservation with low voltage for lining, as well as key technical issues of improvement of current efficiency and alumina quality, bath component control, meanwhile, it makes analysis and discussion on deep energy saving of pots.

关键词：电解铝 磁流体 稳定 节能技术 抑制水平电流 曲面阴极 槽内衬保温 深度节能

Key words: Electrolytic aluminum, magnetic fluid, stability, energy saving technology, suppression of horizontal current, curved cathode, heat preservation for lining, deep energy saving

铝电解系列全电流开/停槽技术经济效益分析及计算方法

The Economic Analysis of On-line Pot Switch on/off Technology

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摘要

此文提供了铝电解系列全电流开/停槽技术的节能、增产和减排效益的分析和计算方法，并结合某电解铝系列的具体生产统计数据，演示了详细的分析和计算过程。

Abstract

This paper provide the method to analyze and calculate the effect of energy-saving, production-increasing and pollution-reducing of the technology to start up & shut down pots under full amperage, moreover, show how to analyze and calculate the effect based on the specific production statistics figures of some electrolytic aluminum pot line.

关键词：铝电解；几何电流密度；无功电耗；原铝减产；当量二氧化碳减排

Keywords: aluminum electrolysis, geometric current density, energy consumption without working, equivalent weight of carbon dioxide reducing

抑制电解槽水平电流的研究与应用

Study of Horizontal Current Suppression in Aluminium Smelting Pots in Aluminum Pot

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摘要

本文首先从设计和生产的角度讨论了影响电解槽水平电流的因素，从理论上分析了减小水平电流对提高电解槽稳定性和降低电解槽能耗的意义，利用 ANSYS 软件，通过有限元分析的方法，给出了计算的边界条件，建立了电解槽的数学模型，模拟分析了原始状态下铝液中的水平电流。针对原始状态下水平电流较大的情况，提出了几种能有效降低电解槽水平电流的方法，并对各种方式下的抑制水平电流效果进行了比较，特别是对梯形扎糊式抑制水平电流方式做了比较详细的分析。最后结合现场生产情况，对多种抑制水平电流措施所取得的效果进行了比较，并对各种抑制水平电流措施进行了总结。

Abstract

In this article, the causes which influence pot stability are analyzed, the significance of less horizontal current in pot is presented, and the factors related to horizontal current are exampled; a steady-state electrical field model of pot is established by the way of finite element analysis, with help of ANSYS software, which is used to analyze the horizontal current in aluminum liquid, so as to further guide pot optimum design; based on design and production, a few methods to effectively reduce horizontal current in pot are proposed.

关键词：电解槽；水平电流；有限元法；变截面阴极钢棒

Key words: Aluminum Pot, Aluminum cell, Horizontal current, Finite Element Method, Variable cross-section cathode bars

基于铝电解生产工艺特点的"MPPIC"控制技术的不断优化

Optimization of the“MPPIC”Technology with New Characteristics for Aluminum Electrolytic Process

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摘要

人们通过各种手段不断加大铝电解槽的电流强度和阴阳极电流密度设计，建设超大型预焙铝电解槽系列来减少单位产能的投资。然而，随着铝电解槽型的不断加大，铝电解槽设计的各项静态平衡参数所对应的稳定生产运行的动态平衡参数管理之间的空间也就越来越窄。生产管理运行期间的稍不慎重，都可能导致铝电解槽的异常甚至重大事故的发生，而且铝电解槽越大，调整的时间也越长。面对这一日益严重的挑战趋势，近些年人们对大型铝电解槽以及整个系列的工艺控制策略和生产管理模式提出了越来越高的要求。目前，世界上领先的大型铝电解槽技术都对应配套开发或采用了越来越先进的工艺控制技术。本文在简要回顾当前国内外大型铝电解槽先进的工艺控制技术的同时，着重介绍了贵阳院这些年来基于铝电解生产工艺特点的“多参数工艺智能控制”即"MPPIC"控制技术的不断优化升级的过程及独特的核心内容，最后简要介绍了该控制技术未来的发展趋势及应用前景。

Abstract

In order to reduce the unit investment of the construction for super large CWPB pot & lines, the pot amperage and its anode &cathode current density has been raised progressively. However, with the CWPB pot is becoming super larger, the room is getting much smaller between its static balance parameters designed and dynamic balance parameters which operate the pot in stable condition. If there is any problem occurred during its operation period, it will make the pot unstable, even trouble more seriously. In this case, the pot is larger, the more regulation time is to be needed. As you know this challenge is getting increasingly serious, the higher and higher requirement will be raising for the process control strategy and operation model of the super lager CWPB pot and even whole potline. Now, all advanced large CWPB pot technology in the world had been developed or adopted corresponding advanced process control technology. Based on the brief overview of the pot control technology developments in the world, this paper mainly introduce the optimization progress of the “MPPIC” technology with new characteristics by CHALIECO GAMI. In addition, its application prospect is also forecasted.

关键词：大型铝电解槽；热动力学模型；多参数工艺平衡；最佳性能区域；控制模型优化；炉况分析系统；集成控制系统优化。

Keywords: Large CWPB pot, Thermodynamic Models, Multivariate Process Parameters Balance, The Best Performance Area, Control Model Optimization, Cell Conditions Analysis System, Integrated Control System Optimization.

900kt/a 预焙阳极厂一期工程投产情况介绍

Phase I of the Commissioning of 900kta Prebaked Anode Plant

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摘要

本文介绍了作为商品阳极定位，多规格、大产能 900kt/a 预焙阳极厂的总体规划，同时描述了一期工程时各主要设施情况，包括生石油焦和煅后石油焦均可进料的原料均化设施；石油焦煅烧按照回转窑和罐式煅烧炉的组合设计；目前最大产能生产线的生阳极制造以及大尺寸阳极焙烧炉等。最后介绍了一期工程投产后的运行情况。

Abstract

This article introduces the general planning of a 900kt/a prebaked anode plant which produces the commercial anodes and several specifications of products, and describes each main workshop of the first phase including homogenization facility which both green coke and calcined coke are allowed inside, calcinaiton facility for the green coke which is designed combining rotary kiln and shaft kiln, the past plant which has the biggest capacity of single line and the baking shop which has the largesize baking furnace. Finally, it describes the operation status after start-up.

关键词： 预焙阳极；煅烧；生阳极制造；焙烧

Key words: prebaked anode, calcination, green anode manufacturing, baking

420kA 大型预焙阳极铝电解槽开发与工业化应用

Development & Industrialization Application of 420kA High-amperage Prebaked Anode Pot

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摘要

本文描述了 GAMI 的 420KA 级铝电解槽的设计开发过程，对多种节能降耗新技术在铝电解槽上的应用进行了论述，对 420KA 级预焙阳极铝电解槽的生产数据与主要技术经济指标进行了系统的分析，对各种节能措施在工业化应用中取得的效果进行了总结。特别是针对 GAMI 近年来开发研究成功的曲面阴极技术、磷生铁浇注阴极技术、抑制水平电流技术等进行了说明。最后论证了 420KA 预焙阳极铝电解槽是高效、节能、环保的大型铝电解槽，将成为广泛应用于铝电解工业领域的主力槽型。

Abstracts

The essay describes the design development process of GAMI's 420kA aluminum electrolysis pot, discusses application of various new energy-saving technologies in aluminum electrolysis pot, analyzes systematically process data and main technical & economic index of 420kA prebaked anode pot, summarizes the effects of various energy-saving measures in industrialization application, and especially explains some technologies developed successfully by GAMI during recent years as curved cathode technology, phosphorus pig iron casting cathode technology and horizontal current suppression technology etc. The essay demonstrates at last that the 420kA prebaked anode pot is high-efficient, energy-saving and environmental protection pot, which is to become the leading pot type applied broadly in the aluminum electrolysis industry.

关键词： 420kA 铝电解槽 曲面阴极 磁流体稳定性 水平电流

Keywords: 420kA aluminum electrolysis pot；curved cathode technology；hydromagnetic stability: horizontal currents

基于多元铝电解质体系下的控制思路调整

Adjustment on Control Thoughts Based on Multiple Aluminum Electrolyte System

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摘要

电解铝生产过程中，添加剂的加入改变了电解质的物理化学性质，进而对生产过程中的物料和温度平衡以及过热度产生影响，因此原有的生产控制方式已经无法准确指导电解生产的实际操作，本文就多元电解质体系下的参数定义的调整，提出用矩阵式模式的控制策略和方法。

Abstracts

Due to addition of additive, the physical & chemical properties of electrolyte are changed during production of aluminum reduction, and then the material and temperature balance and the superheat are affected, so the original production control method cannot direct the actual operation of production correctly any more. Therefore, in this article, the control strategy and method with matrix mode are presented as per the adjustment on parameter definition of multiple electrolyte system.

关键词：铝电解质；添加剂；初晶温度；分子比；矩阵

Key words: aluminum electrolyte, additive, liquidus temperature, molecular ratio, matrix

敞开式焙烧炉焙烧过程三维数值模拟研究

3D Numerical Simulation Research for Anode Baking Process in Open-top Baking Furnace

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摘要

敞开式焙烧炉作为预焙阳极生产的焙烧设备，其焙烧过程直接影响产品的质量，本文通过采用数值模拟研究的方法，开发其焙烧过程的三维数值模拟模型，采用实际炉子测试的运行数据作为边界条件，模拟了阳极焙烧过程中的烟气流动、气固传热、漏气、挥发物质的析出燃烧以及燃料的燃烧等现象，分析过程中炉内流场、温度场和气体浓度变化情况，分析焙烧过程产品的升温速率和最终焙烧水平，并采用实际测试数据对模型进行验证，保证了模型结果的可靠性。

Abstract

Open-top baking furnace is the main baking equipment for prebaked anode production. The quality of baked anode is significantly determined by the baking process. This paper show a 3D numerical simulation method for baking process research. Using the actual testing results as the boundary condition of the model, it modeled the phenomena of the gas flow in flue, heat transfer between gas and solid, air leak from pit, volatile emission from green anode, combustion of fuel and volatile. The results were used to analysis the gas flowing field, temperature and mass concentration distribution in the furnace. It also can be used for analysis the heating rate and baking level of the anode. The model was validated by actual measuring data to make sure the reliability of the simulation results

关键词：敞开式焙烧炉，焙烧过程，数值模拟， 焙烧炉

Keywords: Open-top baking furnace, Baking process, Numerical simulation, Volatile, Baking furnace

铝电解厂房风窗结构对作业环境影响的研究

Study on the Influence of Potroom Window Structure on Working Environment

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摘要

在正常生产过程中，老旧铝电解厂房在某些气象条件下，作业平台处自然通风易发生“短路”状况，会造成作业平台局部温度过高和有害物质的积聚。本文针对这一现象对某已建铝电解厂房提出了在通风窗外增设外挡风板的方案，并运用 CDF 对不同方案的通风效果进行对比，得到最优的外挡板方案。为评价改造方案可行性，对改造后的车间进行测试与分析，证实模型的正确性，该方法和结果可对今后电解车间改造提供依据。

Abstract

In normal production, short-circuit of natural ventilation is very easy to happen at the working platform in some old potrooms under certain weather conditions, which may causes over-high local temperature and accumulation of harmful matters at working platform. In this paper, a solution to add outer air damper at out of ventilation window is pointed out for the potroom of a built smelter, and a optimum air damper solution is finally decided based on comparison on different solutions by CDF. In order to evaluate the feasibility of the innovation solution, the innovated potroom is tested and analyzed, so as to verify the correctness of the model. This solution can be used as basis for future potroom innovation.

关键词：电解铝、作业环境、自然通风、优化、温度

Key Words: Aluminum Electrolysis, Working Environment, Natural Ventilation, Optimize, Temperature

新一代铝电解生产控制系统的开发与应用

New Generation Aluminum Electrolysis Production Control System

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摘要

为挖掘铝电解过程中节能、增效的潜力，开发出新一代铝电解生产控制系统。新系统针对铝电解槽技术的发展，实时优化了现有控制系统的功能，补充完善了新的控制模块，能够利用各种可获取的信息综合解析电解槽的变化趋势，快速跟踪、诊断电解槽异常；捕捉电解槽特性曲线，分析查找异常成因，根除导致异常的源头，达到治标治本的目的。新系统实现了电解槽智能控制、标准化监督管理和标准化分析与操作三位一体的高度集成。生产实践表明，新一代控制系统提升了电解槽的自动控制水平，进一步提高了电解槽生产的稳定性，提高了电流效率，同时，基本消除了阳极效应。

Abstract

A new process control system has been developed for saving energy and improving current efficiency of aluminum reduction pot. Basic control functions of current system have been optimized and new control modules were added. The new system is able to predict the trend and detect abnormalities of the pot by analyzing all kinds of accessible information. Through the analysis of pot trace characteristics, root causes for abnormalities can be found and specific solutions be provided. This system also highly combine process control, standard management and operational routines together. It is shown that the new system not only promote automation dramatically, but also improve the pot stability. As a result, the current efficiency of the pots has been increased and anodes effects been almost eliminated.

关键词：铝电解；过程控制；智能控制；异常监测与诊断；异常处理

Key words: Aluminum Reduction, Process Control, Intelligent Control, Abnormality Detection & Diagnosis, Abnormality Solution

统计过程控制在铝电解全息系统中的应用

Application of Data Analysis in Aluminium Electrolysis Production

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摘要

随着国内铝工业的快速发展，新建现代化大规模铝厂不断增加劳动生产率大幅度提高，生产过程中产生的数据大幅度增加，铝厂的生产过程控制难度逐渐加大，统计过程控制作为一种有效的数据管理分析方法，可以有效的分析铝厂的数据。本文从相关实例论述通过统计过程控制的分析方法来分析铝电解生产过程中的数据，分析生产中的问题并提供有效的解决方案。

Abstract

Along with the rapid development of domestic aluminium industry, large-scale modern aluminium plants have been newly built one after another, resulting in a significant increase in labor productivity, production data and control difficulties in production process. In this context, statistical process control, as an efficient data management and analysis method, can be used to analyze the data of aluminium plants efficiently. This article, based on examples, elaborates how statistical process control is used to analyze aluminium electrolysis production data and production problems, and provide effective solutions.

关键词：统计过程控制；铝电解槽

Keywords: Statistical Process Control; Aluminium Electrolytic Cell

SY400 预焙阳极铝电解槽技术进步与发展

Technical Progress & Development of SY400 Prebaked Anode Aluminium Electrolysis Pot

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摘要

沈阳铝镁设计研究院（SAMI）应用多项技术创新，开发出了 SY400 电解槽技术，首批原型槽于 2007 年 5 月起动并取得良好的运行效果。随着铝工业的快速发展，SY400 技术也进行了针对性的改进和优化，先后开发了多种类型的 SY400 电解槽并取得了广泛的应用，在 SY

系列电解槽技术基础上开发的 SY500 电解槽技术一经推出就得到成功的广泛应用，SY400，SY500 电解槽技术成为铝行业最大、最先进技术平台。

Abstract

SY400 aluminium electrolysis pot technology was developed by Shenyang Aluminium Magnesium Design & Research Institute (SAMI) based on quite a few technical innovations, and the first lot of original pots was started in May, 2007, and good running effects have been obtained with these pots. As the rapid development of aluminium industry, SY400 technology has also been accordingly improved and optimized, various types of SY400 pots have been developed and widely used. SY500 aluminium electrolysis pot developed based on SY series pot technology was widely used successfully once it was developed. SY400 and SY500 have become the biggest and the most advanced technical platform in aluminium industry.

关键词：SY400；SY500；铝电解槽

Key Words: SY400, SY500, Aluminium Electrolysis Pot

低温余热利用技术在铝电解工艺的应用及基本模型的建立

Application of Low Temperature Exhaust Heat Technology in Aluminium Electrolysis and the Creation of Basic model

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摘要

低温烟气是指温度低于 200℃的烟气。铝电解生产工艺的排烟温度通常介于 100～200℃之间，此部分低温余热热能若可合理回收利用，将对降低铝电解工艺能耗起到积极可观的作用。本文介绍了三种低温烟气余热利用方案与基本的数学模型，在今后的工程设计中，应根据不同的工程情况选择合理的方案。最后，本文对余热利用系统对原工艺的积极与消极影响进行了分析与讨论。

Abstract

If the temperature of the gas is lower than 200℃, we will call it " low temperature gas". In the aluminium electrolysis process, the temperature of the gas from aluminium reduction cell usually is between 100 and 200℃. If the energy of exhaust gas can be recycled reasonably, it will be positive effect on reducing the energy consumption of aluminum electrolysis process. Three programmes of low temperature exhaust heat utilizing and the basic mathematic model are introduced in the text. According to different project, we should use the most reasonable programme in the future. At last, the positive and negative effects to the original process will be analysed and discussed in the text.

关键词：低温余热 铝电解 有机朗肯循环 余热利用效率

Keywords: Aluminium Electrolysis，Low Temperature Exhaust Heat，Organic Rankine Cycle, Waste heat utilization efficiency

实现电解铝厂全流程优化的制造执行系统软件-SmelterStar

Manufacturing Execution System Software of Electrolytic Aluminum Plant-wide Optimization - SmelterStar

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摘要

实现电解铝厂全流程优化控制有助于解决电解铝厂生产成本高，资源消耗大，环境污染等问题，在车间级控制基础之上建设 MES 系统是实现电解铝厂全流程优化控制的必经之路，本文介绍了沈阳铝镁设计研究院有限公司自主研发的具有完全知识产权的电解铝厂制造执行系统软件-SmelterStar。

Abstract

The plant-wide optimal control is helpful to solve many problems, such as high production costs, large resources consumption，serious environmental pollution and so on. To achieve the goal of aluminum plant-wide optimal control, we could do nothing but build a MES system which is based on workshop level control systems. An electrolytic aluminum plant manufacturing execution system software which

is named SmelterStar is proposed in this paper. This software has full intellectual property rights and it is researched by Shenyang Aluminum & Magnesium Engineering & Research Institute Co.Ltd.

关键词：电解铝厂，制造执行系统，SmelterStar

Key Words: Aluminum Electrolytic Plant, Manufacturing Execution System, SmelterStar

铝电解槽阴极导电结构创新节能技术研究及工业试验

Research and Pilot Testing on The Novel Cathode Conducting Structure Energy-saving Technology in Aluminum Reduction Pots

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摘要

本文从研究铝电解槽磁流体稳定性与铝液中水平电流和垂直磁场的关系入手，通过研发设计垂直阴极炭块底面布置的阴极钢棒，降低铝液中水平电流约 90%，降低了垂直磁场及其梯度。在 220kA 电解槽进行了有关的阴极炭块组研究及工业试验，取得了炉底压降降低约 100mV，电流效率提高 0.54%，吨铝直流电耗降低 570kWh 的显著节能效果。阴极导电结构创新节能技术研制成功，不仅揭示了降低水平电流技术对电解槽磁流体稳定性的大幅提升作用，同时也给电解槽设计带来一些启示。电解槽稳定性设计一方面要做好母线系统优化设计，另一方面要关注阴极导电结构和水平电流优化设计。

Abstract

The article focuses on research of the relationship between magneto-hydrodynamic stability of the pot and horizontal current and vertical magnetic field in the metal. Through collector bars arranged vertically to the bottom of cathode blocks, horizontal current is reduced by 90%, then vertical magnetic component and its gradients in the metal are reduced significantly. Testing the bottom-current-exit cathode block was carried out on 220kA pot. Good performance was achieved with cathode voltage drop cut by about 100mV, current efficiency increased by 0.54%, energy consumption saved by 570kWh per ton aluminum. The successful making of the novel cathode conducting structure not only demonstrates that the reduction in horizontal currents gives the benefits on pot stability, but shows some new directions on pot design, e.g. with an emphasis on cathode structure and horizontal currents design except that the traditional busbar system design.

关键词：磁流体稳定性 水平电流 阴极压降 底部出电阴极结构

Key words: magneto-hydrodynamic, horizontal current, cathode voltage drop, bottom-current-exit cathode structure

高导电性阴极钢棒在 300KA 电解槽的生产实践

High Conductivity of the Cathode Steel Bar in the Production Practice of 300KA Cell

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摘要

我国铝电解生产近年来发展飞速， 300KA-500KA 电解槽已成为主力生产槽型，随着制造、材料等新技术不断进步，电解槽装备、技术得到空前的提升[1]，为大幅降低能耗提供了宝贵的空间。高导电性阴极钢棒（型材）就是相对传统的普通钢材阴极（型材），通过材质和物理尺寸变化，改变导电率和调整电阻，优化阴极电流磁场各项技术，完成低电压条件下正常电解高效生产，从而降低铝电解生产电耗。

Abstract

China's electrolytic aluminum production in recent years the rapid development of 300KA-500KA, electrolytic tank has become main production groove, with new manufacturing technology, material progress, electrolytic bath equipment, technology of an unprecedented increase in [1], provides a valuable space for greatly reducing the energy consumption. High conductivity of the cathode steel bar (profile) is compared with the traditional common steel cathode (profile), through the material and physical size change, change the conductivity and resistance adjustment, optimization of cathode current magnetic field technology, low voltage conditions normal electrolytic efficient production, thereby reducing the power consumption of electrolytic aluminum production.

关键词：铝电解 高导电阴极钢棒 降低能耗

Keywords: aluminum electrolytic high conductive cathode steel bar and reduce energy consumption

电解铝厂生产全过程自动控制技术开发及应用

Development and Application of Automatic Control on Aluminum Electrolysis Production Process

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摘要

近年来，新建电解铝项目规模越来越大，供电电压等级不断提高，对电解铝厂的安全生产、自动控制、高效管理等提出了更高要求。为适应现代电解铝行业发展趋势，本文提出了建设一套电解铝厂生产全过程自动控制技术，实现电解铝厂生产运行全过程的控制和监视，系统功能涵盖生产自动控制、设备状态监测、生产安全保障、能耗节能管理等四方面，不仅是技术上、也是管理模式上的一次重大创新，大大提高了电解铝厂自动控制水平。上述成果已在中国电力投资集团公司宁夏能源铝业宁东公司、重庆分公司天泰铝业成功应用，取得良好的经济和社会效益。

Abstract

Recently the scale of newly built smelter is getting bigger, the voltage level of power supply for these new smelters are increasing. This requires higher standards for safe production, automatic control and efficient management. In order to adapt to the development trend of aluminium smelting industry, the authors propose to establish a new system of automatic control technologies for the whole production process of aluminium smelter to monitor and control the whole production process of aluminium smelter. The functions of the system cover the automatic control of production, monitoring of equipment conditions, guaranteeing production safety and managing energy consumption reduction. The system is not only a technical innovation, but also an innovation of management method. This system improves automatic control level of aluminium smelter. the system has been implemented in two aluminium smelters of China Power Investment Corporation, Ningxia Ningdong and Chongqing Tiantai, resulting excellent economic and social benefits.

关键词：电解铝厂 全过程 自动控制 技术 应用

Key words: Smelter, process, automatic control, technology, application

“CC”电解烟气净化控制技术的研究

Circle-centre Dry Scrubbing Cortrol System Research

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摘要

在电解铝生产过程中，会产生大量有害烟气，这种气体严重危害人类的健康，破坏生态环境。本文针对电解铝生产过程，研发了“CC”烟气净化控制技术。结合电解铝烟气净化工艺过程，在生产安全稳定的前提下，以提高粉尘排放指标合格率以及总氟排放指标合格率为优化控制的目标，采用前馈与反馈相结合的优化控制方法，提高电解烟气净化指标，解决铝电解产生的环境污染问题。

Abstract

In the process of aluminum electrolysis production, there is large harmful fume will be produced. This fume will destroy human health and ecological environment badly. Aiming at the process of aluminum electrolysis production, this paper develops a control system of the circle-centre dry scrubbing technology. In combination with electrolytic aluminium flue gas purification process, under the premise of security and stability in production and achieve the goal of improved the qualified rate of dust emission index and total fluorine emission percent of pass is the goal of optimal control, we use the combination of feed forward and feedback optimal control method to improve the efficiency of purification and resolve the problem of environmental pollution.

关键词：铝电解；烟气净化；PLC 网络控制；优化控制

Key words: Aluminum electrolytic, Flue gas purification, PLCnetworks, Optimal control

4343A/3003/4343A铝合金三层复合材料加工工艺研究

Research on Fabrication Process for 4343A/3003/4343A Aluminium Alloy Composite

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摘要

本文介绍了 3003/4343A/3003 三层铝合金复合材料的主要用途、性能要求、加工原理、加工工艺流程及其加工工艺参数，分析了影响复合轧制效果的主要因素，并针对其加工过程中常见质量缺陷提出了解决措施，所生产的三层复合料性能完全满足用户要求。

Abstract

This paper introduces the main uses， performance requirement，processing principle，fabrication process ， technological flow and its technological parameters for 3003/4343A/3003 three layers aluminium alloy composite，and analyzes the main factors affecting composite rolling effect，and put forwards some solving measures according to the common quality defects in composite processing process，the performances of three layers composites produced accord with the user’ requirement completely.

关键词：铝合金；复合材料；加工工艺

Keywords：aluminium alloy，composite material，fabrication process

高纯净度3003铝合金电解铝液熔铸工艺研究

Process Research on Electrolytic Aluminum Liquid Casting Process of High Purity 3003 Aluminum alloy

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摘要

通过利用电解铝液直接铸造技术，在熔铸生产过程中对在线过滤、铸造参数等熔铸工艺进行研究，生产出满足客户要求的高纯度 3003 铝合金，获取高附加值铝产品。

Abstract

The direct casting technology through the use of electrolysis aluminum liquid, conducts the research to the on-line filtration, casting parameters such as casting in casting production process, to meet the production of high purity 3003 aluminum alloy customer requirements, access to high value-added aluminum products.

关键词：高纯净度、3003 铝合金、铝液熔铸 工艺研究

Keywords: high purity, 3003 aluminum alloy, aluminum casting, process research

绝缘设备的局部放电测量——常规和非常规检测方法

Partial Discharge Measurement of Equipment insulation -- Conventional and Unconventional Detection method

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摘要

本文综述了在线式局部放电测量领域中最新的检测方法，除了常规的脉冲电流法，一些非常规的局部放电检测方法也正在取得现场应用，包括超高频辐射、超声波检测、紫外成像探测和油中气体分析等。本文对常规的和非常规的检测方法从传感器、信号频带、检测参量等方面加以比较，说明在现场应用中常规的脉冲电流法难以克服的问题是放电信号容易受到电磁脉冲的干扰，而这些非常规的局部放电测量方法正是在抑制干扰问题上各有胜处。最后，本文指出联合采用常规和非常规的局部放电检测方法是未来局部放电测量的重要发展方向。

Abstract

This Paper summarize several novel PD (Partial Discharge) detection methods in the on-site applications, including UHF (Ultra High Frequency), AE (Acoustic Emission), UV Photomultiplier,

DGA (Dissolved Gas Analysis) etc., besides the conventional Impulse Current method. By comparing the conventional and unconventional methods throughout sensor, bandwidth, and parameter measurement, it is pointed out that high ratio of noise level per PD signal becomes the biggest problem by applying conventional impulse current method for PD detection in-site. Nevertheless, those unconventional methods supply some possibility in noise suppression. At last, it is mentioned that by joint of the conventional and unconventional method will be an important PD survey strategy in the future.

关键词：局部放电，脉冲电流法，超高频，超声波，紫外成像，油中气体分析

Keywords: Partial Discharge (PD), Impulse Current (IC), Ultra High Frequency (UHF), Acoustic Emission (AE), UV Photomultiplier, Dissolved Gas Analysis (DGA)

Test and Analysis of Thermo-electric Field for 420KA Pot

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Abstract

The article makes analysis on the operating situation of a 420KA pot based on the overall thermo-electric test on it. It tests the voltage drop of each part of pots and makes comparison with the engineering values; meanwhile, it tests the cavity shape and analyzes the developing rules of cavity of high current density pots. What's more, heat dissipation of each part is calculated and analyzed in details, which provides the basis for the engineering of large pots. Combined with each testing contents and production situations, it put up some recommendations for the engineering of ultra-large type pots in our country.

Application of 3D Technology in Aluminium Industry

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Abstract

The study specifies that the existing 3D technology can play an important role in engineering, construction and production of aluminum industry, especially for multi-specialization coordination and precise design in design links. The technology can create values for the overall planning of project, materials statistics of the purchasing, coordination in construction and organization & management of project construction etc. The present paper also gives the basic organization structure of 3D technology and engineering coordination.

Keywords: 3D, multi-specialization coordination, precise design, overall planning, materials statistics, collision, organization management

Comprehensive Application of Energy-saving & Discharge-reduction Technology in Pre-baked Anode Production

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Abstract

The present study describes application of the energy-saving & discharge-reduction technology in petroleum coke calcinations, green anode manufacture and baking etc. in the pre-baked anode plant. It also introduces the benefits of the energy-saving & discharge-reduction technology of each production procedure by comparing to the original technology. Based on present study, it has been concluded that the application of the energy-saving & discharge-reduction technology in the whole pre-baked anode plant can bring the appreciable economic and social benefits.

Keywords: Pre-baked anode, energy savings, discharge-reduction technology, petroleum coke, green anode

Industrial Application of 420kA High-amperage Prebaked Anode Pot

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Abstract

The paper describes the design development process of GAMI's 420kA aluminum electrolysis pot, discusses application of various new energy-saving technologies in aluminum electrolysis pot. The various processes like systematic analysis of process data and technical & economic index of 420kA prebaked anode pot are also discussed. Effects of various energy-saving measures in industrial application and some technologies developed successfully by GAMI during recent years as curved cathode technology, phosphorus pig iron casting cathode technology and horizontal current suppression technology etc also elaborated in this study. The research demonstrate that operation of 420kA prebaked anode pot is highly efficient, energy saver and environmentally protective, which will become the leading pot technology and can be applied widely in the aluminum electrolysis industry.

Keywords: Prebaked Anode Pot, energy saving, 420kA electrolytic pots

900kt/a预焙阳极厂一期工程投产情况介绍

The Briefing of Start-up for the First Phase of 900kt/a Prebaked Anode Plant

程尚清

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Abstract

This paper describes the overall planning and execution of the multi-size and high-capacity 900kt/a pre-baked commercial anodes along with its main operating facilities. In Phase I, raw material homogenizing shop for both green and calcined petroleum cokes and the petroleum coke calcination are designed as the combination of rotary kiln and shaft kiln; green anode manufacture shop with the higher capacity for large size anode baking furnace etc. The paper describes the operational condition of the plant put into operation during Phase I.

Development and Application of High Amperage Aluminum Smelting Technology in China

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Shenyang Aluminum Magnesium Design & Research Institute Co., Ltd,
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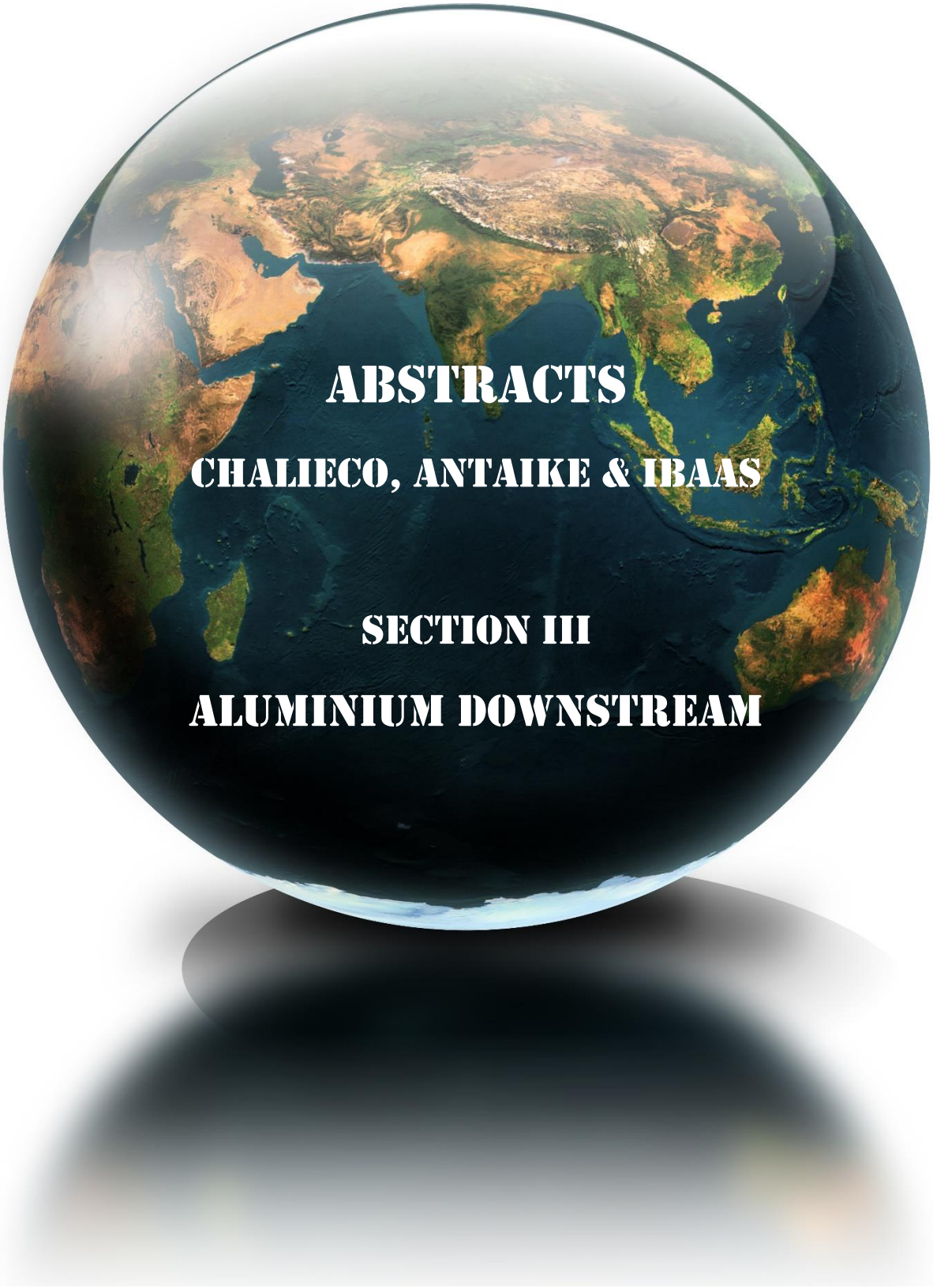
Abstract

In recent years there has been rapid growth in pot amperage in aluminium smelting technology in China due to increase in newly built aluminum smelters, rising of energy prices and new industrial policies. This paper reviews the present development status of high amperage pots in and outside China with special emphasis on its history, technical features and application status. The paper also discusses the aspects of energy saving, pot efficiency, pot intelligence and environment friendly behavior with respect to high amperage pots.

Keywords: Aluminum Electrolysis Pot, Energy-saving, High Efficient, Large Capacity



ABSTRACTS

CHALIECO, ANTAIKE & IBAAS

SECTION III

ALUMINIUM DOWNSTREAM

A Potential Technology for Production of Aluminium and Alloys by Carbothermal Reduction of Bauxite

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Abstract

The commercial technology for aluminium production includes production of alumina from bauxite and smelting of alumina to produce aluminium. Production of alumina from bauxite by Bayer process consumes a large amount of caustic soda and generates a hazardous red mud waste. Aluminium smelting by electrolysis is energy intensive, and a major source of greenhouse gas emissions and harmful fluoride emissions. Carbothermal reduction of bauxite is a promising alternative technology for aluminium and aluminoalloy production.

An innovative technology for processing of bauxite is to reduce the metal oxides in the bauxite ores stepwise. The first stage is to reduce iron oxides and separate metallic iron from other oxides. An alloy of iron-silicon-aluminium can also be obtained by controlling adequate temperature. Further processing consists of reduction of alumina into aluminium carbide and its decomposition into aluminium vapour and carbon. High purity aluminium can be obtained by condensation of aluminium vapour. The proposed technology will avoid generation of red mud and emissions of fluorine occurred in the current aluminium electrolysis process, and will not form an alumina-aluminium carbide melt which causes severe engineering issues of reduction of alumina in a molten phase.

3004/4045 铝合金复合锭坯轧制及热处理工艺研究

Study on the Technology of Rolling and Heat Treatment for 3004/4045 Aluminum Alloy Composite Ingot

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摘 要

本文以半连续铸造所制备的 3004/4045 铝合金复合锭坯为研究对象，首先研究了均匀化退火工艺，接着对其在轧制过程中的变形规律做了细致的对比和分析，并通过对 H14 性能的考察，

从而获得一套比较合理的轧制工艺；最后讨论了板材冷轧后的热处理制度，并对其退火工艺进行了优化。结果表明：在均匀化过程中，加热温度和保温时间对均匀化效果有着直接的影响，并且当加热温度为 560℃，保温时间为 12 小时，3004/4045 复合锭坯具有良好的均匀化效果；冷轧过程中，当首道次的压下为 40%，中间道次控制在 20%～30%之间，且末道次变形为 25%时，轧后复合板材具有较好的力学性能；要使冷轧后的 3004/4045 复合板材具有较好的塑性，且保留一定的强度，不完全退火的温度应在 260℃～300℃之间选择。

Abstract

The composite ingot produced by semi-continuous casting were used in this study. First the homogenization was invested so the suitable homogenization temperature and holding time were obtained. The deformation regulation in rolling process was studied and a reasonable rolling process was obtained by mechanical properties measurement under H14 condition. The heat treatment of the clad sheets after cold rolling was studied and optimized. The results show that: The two main factors during the process of homogenization are heating temperature and holding time, when the temperature is 560℃ and holding time is 12 hours, the composite ingot can have a good effect of homogenization; During the process of cold rolling, when the first-pass reduction rate is 40%, the mid-pass reduction rate is between 20% and 30%, the finishing-pass reduction rate is 25%, the clad sheets will have a better mechanical property; To have a better plasticity and suitable strength for clad sheets after cold rolling, the annealing temperature should be chosen between 260℃ and 300℃.

关键词: 复合锭坯；均匀化；轧制；退火

Keywords: composite ingot, homogenization, rolling, annealing

4343A/3003/4343A 铝合金三层复合材料加工工艺研究

Research on Fabrication Process for 4343A/3003/4343A Aluminium Alloy Composite

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Abstract

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Keywords: aluminium alloy, composite material, fabrication process

高纯净度 3003 铝合金电解铝液熔铸工艺研究

Process Research on Electrolytic Aluminum Liquid Casting Process of High Purity 3003 Aluminum alloy

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Abstract

The direct casting technology through the use of electrolysis aluminum liquid, conducts the research to the on-line filtration, casting parameters such as casting in casting production process. The given process meets the customer requirements for the production of high purity 3003 aluminum alloy and access to high value-added aluminum products.
Keywords: high purity, 3003 aluminum alloy, aluminum casting, process research

绝缘设备的局部放电测量
—常规和非常规检测方法

Partial Discharge Measurement of Equipment insulation -- Conventional and Unconventional Detection method

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Ding Liwei, Zhou Guang, Han Haipeng

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Abstract

This Paper summarizes several novel PD (Partial Discharge) detection methods in the on-site applications, including UHF (Ultra High Frequency), AE (Acoustic Emission), UV Photomultiplier, DGA (Dissolved Gas Analysis) etc., besides the conventional Impulse Current method. By comparing the conventional and unconventional methods throughout sensor, bandwidth, and parameter measurement, it is pointed out that high ratio of noise level per PD signal becomes the biggest problem by applying conventional impulse current method for PD detection in-site. Nevertheless, those unconventional methods supply some possibility in noise suppression. At last, it is mentioned that the joint conventional and unconventional methods will be an important PD survey strategy in the future.
Key words: Partial Discharge (PD), Impulse Current (IC), Ultra High Frequency (UHF), Acoustic Emission (AE), UV Photomultiplier, Dissolved Gas Analysis (DGA)

4032 铝合金铸锭偏析层厚度的检测与分析 Detection and Analysis of Segregation Layer Thickness of 4032 Alloy

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摘要

本文分别采用金相法、扫描电镜 EDX 能谱、光电直读光谱法测试 4032 铝合金铸锭表面偏析层厚度，结果发现：采用光电直读光谱法虽能准确检测出偏析层厚度，但检测过程繁琐且检测费用较高；而采用扫描电镜 EDX 法很难准确地检测出偏析层厚度；采用金相法能简单、快速地检测出偏析层厚度，铸锭表面与粗大α-Al 树枝晶的厚度即为偏析层厚度。

Abstract

Experiments were carried out to investigate surface segregation of 4032 alloy by EDX spectroscopy, photoelectric direct reading spectrometer and metallographic method. The results show that photoelectric direct reading spectrometer can accurately detect the thickness of segregation layer. However, the process is cumbersome and expensive. It is difficult that EDX analysis can accurately detect segregation layer. Metallographic method can quickly and easily detect the thickness of segregation layer, which is the distance from the surface of ingots to coarse dendrite of ingot surface.

关键词: 4032 铝合金；偏析层厚度；EDX 能谱；光电直读光谱；金相法

Keywords: 4032 alloy; segregation layer thickness; EDX analysis; photoelectric direct reading spectrometer; metallographic method

暖通专业几种节能新方法 在有色金属加工设计中的运用

Several New Energy Saving Methods on HVAC Professional used in Non-ferrous Metal Processing Design

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摘要

随着国家实现节能减排目标和总体要求的进一步明确，节能减排的技术创新突显重要。本文有针对性的介绍了在有色金属加工设计中熔铝炉及保温炉烟气的新型余热利用方法、冷却室的新型设计方法、轧机控制室通风空调设计新方法等几种节能新技术的运用。

Abstract

As countries realizing the further clear goal of energy conservation and emissions reduction and the general requirements, technological innovation of energy saving and emission reduction is highlight important. This paper targeted in non-ferrous metal processing design illustrates several kinds of new technology of energy saving using, such as a new type of waste heat utilization in aluminum melting furnace and holding furnace flue gas, a new method of cooling chamber, and a new method of ventilation and air conditioning in mill control room.

关键词：节能减排；余热利用；料卷余热量

Keywords: energy conservation and emissions reduction; waste heat utilization; material residual heat

铝箔在药品包装材料中的应用

Application of Aluminum Foil in Pharmaceutical Package Material

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摘要

铝箔以其无毒、高遮光性、阻氧性和防潮性等优点，在药品包装中得到了广泛的应用。随着技术进步，除了传统的泡罩包装用铝箔（PTP）外，铝箔还与各种塑料和纸张等材料复合作为药品包装材料，例如儿童安全型泡罩铝箔、冷冲压成型铝箔、热带型泡罩包装铝箔栓剂散剂复合膜等，本文分析了各种药品铝箔包装材料的结构和用途。

Abstract

Aluminum foil as a non-toxic, ultimate protection against light, oxygen and other gases, moisture material, had been widely applied in pharmaceutical package industry. And with the development of the technique, except for the traditional Press Trough Tackage aluminum foil(PTP), aluminum foil laminated with various plastic and paper had been used as medicine package material, such as Child-Resistant Blister aluminum foil, Cold-form aluminum foil, hot strip blister aluminum foil, Strip pack and Suppository aluminum foil. This article analyses the structure and function .of various pharmaceutical package aluminum foil.

关键词：铝箔 药品包装材料 结构 功能

Keyword: Aluminum foil; pharmaceutical package material; structure; function

金属复合板带材轧制复合技术与装备研发

Research ＆Development on the Technology and Equipment of Metal Clad Plate

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摘要

本文分析了金属复合板带材热轧复合和冷轧复合的工艺技术，介绍了国内轧制复合设备的结构特点，阐述了冷复合轧制装备的工艺要求和研究重点。这对拓展金属复合板带材的应用范围，转移金属板带材过剩产能，推进产品结构调整以及加快企业转型升级具有一定的意义。

Abstract

The paper compared the technological characteristics of hot-rolling bonding and cold-rolling bonding in the production of aluminum alloy composite strips. It introduced the research progress and application status of domestic rolling composite equipment. On the basis of them, it points out that the

cold rolling composite mill is energy-saving and green and states the research focus and developing direction of cold rolling composite equipment. This has a certain significance to expand the application scope of aluminum products, transfer of aluminum processing overcapacity, promote the product structure adjustment and accelerate the transformation and upgrading of enterprises.

关键词：复合工艺；金属复合板；复合轧机；热轧；冷轧

Keywords：Aluminum alloy；Metal clad plates；Composite mill；Hot rolling；Cold rolling

大型铝挤压型材在线淬火技术及装备

On-line Quenching Technology and Device of Large Aluminum Alloy Extrusion Profiles

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摘要

简要介绍了大型铝挤压型材生产技术，分析了影响制品在线淬火性能和质量的关键因素，详细阐述了国际上先进的在线精密淬火装置制造特点，提出了国产在线淬火装置改进和发展方向。

Abstract

This paper briefly introduces the production technology of large aluminum extrusion profiles, analyzes the key factors affecting the performance and quality of on-line quenched products, in detail elaborated the manufacturing characteristic of international advanced on-line precision quenching device, and proposed improvement and development direction of the domestic online quenching device.

关键词：铝合金型材；在线淬火；精密淬火装置

Key words: extrusion of aluminum alloy; on-line quenching, precision quenching

Upgradration and Optimization of Aluminium Foil Rolling Oil Mist Collection System

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Abstract

The conjugation of three towers, the improvement of heating source, and the development of multi-absorber reduplicative spray process are used to upgrade and optimize the aluminum foil rolling oil mist collection system. It makes the oil mist collection system reasonable in design, stable for running, energy-saving, low-costing, and widely used.
Keywords: oil mist collection system; energy saving; emission reduction, the conjugation of three towers; electric heater; multi-absorber reduplicative spray

Analysis of Aluminum Alloy Profile Process for Rail Train

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Abstract

Because of large section, thick wall, complex shape and strict requirement on dimensional tolerance, advanced and reliable process in Aluminum alloy profile production for rail train is very important. The process, including melting and casting, extrusion, heat treatment, machining and welding, will be discussed in this paper.
Keywords：rail train；aluminum alloy；profile；extrusion；weld

Optimization of Design for the Structure of Belt Wrapper

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Abstract

This paper introduces the principles of belt wrapper. And the optimization design on the structure was proceed for the problems of belts, such as insufficiency of clasping force, inconvenient of replacing belt and deviation. Practical production shows that the improved structure is reasonable, solved the technical problems in production.
Keywords: Belt Wrapper, Optimization, Design, Clasping Force, Deviation

工业自动化系统远程诊断与维护

Remote Diagnosis and Maintenance

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摘要

介绍通讯领域中的 VPN 即虚拟专用网技术及其分类，分析各种 VPN 技术特点和适用环境，结合工控领域内远程诊断与维护的具体特点和需求，以及各类厂家的实际网络情况和技术能力的差异，分为三类分别采用不同形式的 VPN 技术，将工控领域的 PLC 控制系统和控制网络与其相对接，从而实现工控领域的远程诊断与维护。该文通过具体项目，利用文字和图片按步骤的详细举例说明了操作过程，同时总结了实际应用中可能遇到的常见问题，并对国内网络现状进行介绍给出网络选择时的注意事项。

Abstract

Introduction to communications in the field of VPN virtual private network technology and its classification, analysis of a variety of VPN technology characteristics and application environment. Combined with the industrial areas of remote diagnosis and maintenance of specific characteristics and needs, as well as the manufacturers of all types of practical network and technical ability, divided into three types with different forms of VPN technology, the industrial control area of the PLC control system and control network and its docking, thereby realizing the industrial areas of remote diagnosis and maintenance. In this paper, through specific items, using words and pictures according to the steps detailed examples of the operation process, and summarizes the practical applications may be the common problems encountered, and the domestic network status of the given network selection matters needing attention.

关键词：VPN 虚拟专用网；PPTP 点到点隧道协议；DDNS 动态域名服务；IPSec 一种开放标准的框架结构，通过使用加密的安全服务以确保在 Internet 协议 (IP) 网络上进行保密而安全的通讯

Keywords: VPN Virtual Private Network; PPTP Point to Point Tunneling Protocol; DDNS Dynamic Domain Name Server; IPSec Internet Protocol Security

Design of 2400mm Single Stand Hot Reversing Mill for Aluminium Strip

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Abstract

Aluminum strip is widely used in machinery, electronics, aviation, transportation, construction, printing, defence and other industries. With the continuous and rapid development of the national economy, large amounts of high-quality wide aluminum strips are required. In this context it is

necessary to continuously improve the aluminum processing technology, and independently develop the wide rolling equipment to a higher level.

This paper mainly introduces the main performance parameters of the 2400mm single stand hot rolling mill with double coilers. The process for aluminum strip hot rolling, details of the necessary equipment, their configurationally characteristics, as well as improvements for future design are discussed. The analysis focuses on the characteristics of the whole hot line, mill， and new unit equipment. And combined with the actual production process it analyses the performance and structure characteristics of rolling capacity, unit equipment configuration and design structure. This paper also summarizes some disadvantages of previous design or location and puts forward some improvement scheme for the final rolling temperature control, centring guides, coiler, heavy duty hydraulic shear, vertical edge rolls and product positioning.

Keywords: single frame main engine, coiling machine, edging mill, convexity measuring instrument, working roll, supporting roll, mill speed

The Application and Development of Aluminum Slag Processing Equipment

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Abstract

This paper introduces the application of aluminum slag processing equipment background, aluminum dross processing methods and major equipment. The article provides statistics of the current slag processing equipment in domestic applications, analyzes and describes the slag processing equipment used in China. Based on these developments, paper recommends that the domestic equipment manufacturers should take note of these new equipments. Finally, through the exhibition of domestic aluminum slag processing technology and equipment, the development prospects are also presented.

Keywords: aluminum slag processing; present situation; development prospects; environmental protection equipment

工业数据采集及报表软件的开发与应用

Development and Application of Industrial Data Acquisition and Statements Software

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摘要

工业生产过程数据的记录与查看是设备故障监控、优化生产工艺的有效手段。中色科技苏州院结合有色金属加工的生产特点自主开发了数据采集与报表软件，可通过多种通讯方式，连接多台设备进行多线程高效采集，满足生产实时曲线监控、过程数据记录与统计、PDF 报表和网页报表定制等需求，支持数据的开放式共享访问，有利于厂方对数据的拓展应用。该软件已在铝热轧、冷轧生产线上得以应用，为相关企业创造了显著的经济效益。

Abstract

In Industrial production, process data is the most effective means of equipment abnormity monitoring and optimization of production process. Data acquisition and statements software is an independent development of CNPT-SINR. Through a variety of communication means, the software can connecting multiple devices for multithreaded efficient acquisition, as more as real-time monitoring、PDF statements and webpage report which is customization demand. It also support the data access of other data applications, which can satisfy extension use of factory, The software has been used and creating significant economic benefits for enterprises in many aluminum hot rolling production lines and cold rolling production lines.

关键词： 过程数据采集、报表系统;实时曲线监控;过程数据统计

Keywords: Process data acquisition; Statements system; Real-time monitoring; Process statistics

磷变质后期工艺对过共晶 Al-Si 合金变质效果的影响

Effects of Post-processing Parameters on Modification Results of Hypereutectic Al-Si Alloy Modified by Phosphorus

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摘要

借助光学显微镜观察分析了过共晶 Al-Si 合金的初晶硅组织，研究了熔体实际磷（P）含量、浇注温度和冷却速度等后期工艺对 P 变质过共晶铝硅合金中初晶硅效果的影响。结果表明：

熔体实际P含量、浇注温度和冷却速度显著影响P变质初晶硅的效果，提高熔体实际P含量、浇注温度和冷却速度，明显改善 P 变质效果。在熔体实际 P 含量为 200 ppm、浇注温度为 780 oC、冷却速度为 20 oC/s 工艺下，初晶硅细化效果明显，平均尺寸为 24μm，且分布均匀。

Abstract

The effects of later processing parameters such as the real phosphorus (P) content in melt, pouring temperature and cooling rate on the refinement of primary silicon particle of A390 aluminum alloy are investigated by applying metallographic technology. The results demonstrate that the efficiency of P modification is influenced apparently by these three processing parameters. Increasing real P content in melt, pouring temperature and cooling rate can enhance efficiency of P modifying primary silicon particles. Under the condition that real P content is 200 ppm, pouring temperature is 780 oC, and cooling rate is above 7 oC/s, the primary silicon particles are refined significantly with the average size of 24 μm and uniform distribution.

关键词：过共晶 Al-Si 合金；变质；初晶硅；浇注温度；冷却速度

Key words: Hypereutectic Al-Si alloy; modification; primary silicon; pouring temperature; cooling rate

Highly Advanced Efficiency and Quality Isothermal Smelting Technology of Aluminum and Aluminum Alloys

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Abstract

Isothermal melting technology of Al and Al alloy is regarded as a significant technology because of its great technical and economical advantages. Such systems were established and a series of experiments were carried out in the paper. We can found that the total thermal efficiency of the systems can be improved to 70%, the temperature fluctuation of the Al and Al alloys liquid was ±3^{o}C, leading to the high quality of molten Al and Al alloys obviously.

Keywords: Al and Al alloys, isothermal melting technology, total thermal efficiency, the temperature fluctuation

均匀化处理对高硅多元铝合金组织的影响

Effect of Homogenization Treatment on Microstructure of High Silicon Aluminum Alloy

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摘要

研究了均匀化温度、均匀化时间和均匀化后的冷却速率对 A390（17.5%Si）铝合金微观组织演变及布氏硬度的影响规律。结果表明：均匀化各工艺参数对共晶硅及第二相的形貌、尺寸和分布均有明显影响。均匀化处理后，共晶硅明显粒化和球化，初晶硅变化不明显。均匀化后合金的冷却速率越小，组织中析出的第二相数量越多。500℃保温 8h 随炉冷却条件下，共晶硅平均最大线长度为 2 ~ 3μm，形状系数为 0.36，并且 Al2Cu 相发生球化，Al5Cu2Mg8Si6 相数量增加。

Abstract

The effects of homogenizing treatments including temperature, time and cooling rate on microstructure evolution and Brinell hardness change of the A390 aluminum alloys (17.5%Si) are investigated. The results indicated that the shape, size and distribution of eutectic silicon, as well as intermetallic phases were closely related to the homogenizing parameters. With suitable homogenization treatment, the eutectic silicon tends to round apparently, and little variation appeared in primary Si particles. After the treatment 500℃×8h with furnace cooling, the average maximum line length of eutectic silicon is about 2~3μm and the shape factor is 0.36 respectively. Al2Cu phase were observed to be remarkably spheroidized, as well as the number of Al5Cu2Mg8Si6 phase were found to be significantly increased.

关键词：A390 铝合金; 均匀化; 微观组织;共晶硅；布氏硬度

Keywords: A390 aluminum alloy; homogenization; microstructure; eutectic silicon; Brinell hardness

3104 铝合金低液位铸造扁锭质量研究

Study on Ingot Quality of 3104 Aluminum Alloy by Low Head Casting (LHC)

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摘要

本文研究了低液位铸造过程中液位高度、石墨内衬温度和冷却水流量对 440mm×1320mm 规格 3104 铝合金铸锭质量的影响。结果表明：控制液位高度使得铸模单独冷却距离在 20~25mm；确保石墨内衬与结晶器壁贴合严密使得石墨内衬温度在 200℃下；优化冷却水量使得铸锭启铸阶段第一主应力数值从 165Mpa 减小至 102Mpa，能够获得高表面质量无裂纹铸锭。

Abstract

The effects of liquid control limit, graphite plate temperature and cooling water distribution on ingot quality of 3104 aluminum alloy by Low Head Casting (LHC) were investigated in this paper. In order to cast the high quality LHC ingot, the single cooling distance of the mold must be controlled from 20mm to 25mm and the graphite plate temperature below 200℃, which indicated that the graphite plate is deep contact with the mold. The ingot crack tendency can be successfully suppressed by modulating the cooling water distribution and the first principle stress of the ingot need to be decreased from 165Mpa to102Mpa.

关键词：半连续铸造；低液位铸造；3104 铝合金；裂纹；石墨内衬

Keywords: casting; LHC; 3104 alloy; crack; graphite plate

辊底式铝合金固溶热处理炉

Roller Hearth Furnaces for the Solution Treatment of Aluminum Alloys

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摘要

辊底式铝合金固溶热处理炉具有工艺先进、自动化以及产品质量高、无污染、单位能耗低等优点，但进口设备价格昂贵，推广普及存在很大困难。我公司通过多年研究开发，于2012年

底完成了国产化的辊底式铝合金固溶热处理炉带载测试，取得了良好的实验结果，目前该设备已经开始推向市场。

Abstract

Roller-hearth furnaces for the solution treatment of aluminum alloys have the advantages in high levels of process technology and automation, high product quality, no pollution and low energy consumption for each weight unit of aluminum. However, such furnaces are quite pricy if imported and as a result, the number of imported furnaces is yet limited. On the basis of research and development for many years, at the end of 2012, our company performed the tests of home-made roller-hearth furnaces with aluminum alloy loaded for solution treatment. These tests showed satisfactory results. Since then, the home-made furnace lines have been launched and put into market.

关键词：辊底式、固溶热处理、产品质量高、无污染

Keywords: roller-hearth furnace; solution treatment; high product quality; pollution free

MES 在熔铸炉前分析中的应用

The Application of MES in the Pre-analysis of the Melting and Casting Furnace

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摘要

针对熔铸炉前分析中合金成分难以精确控制、成品率低的难题，在 MES 中开发光谱分析仪通讯接口和炉前分析模块，根据分析结果指导熔炼炉和保温炉进行成分调整，并对铸造过程中的关键参数进行实时监测与报警，实现了光谱分析仪化学成分分析结果与 MES 的无缝对接，现场验证表明提高了炉前分析工作效率和熔铸质量管理水平。

Abstract

In response to the challenge problem which is hard to precisely control the alloy composition and the low yield in the pre-analysis of the melting and casting furnace, the communication interface of the spectrum analyzer and the pre-analysis module of the furnace are developed in MES, which can direct the smelting furnace and the holding furnace to adjust the alloy composition, and real-time monitor the key parameters in the casting process and give the alarm. Therefore, the seamless joint between the MES and the result of the chemical component analysis with the spectrum analyzer has been

realized. The on site testing and verification shows the pre-analysis efficiency of the furnace and the melting and casting quality management level has been improved.

关键词：制造执行系统 ;熔铸;炉前分析;光谱分析仪;化学成分

Keywords: Manufacturing Execution System; melting and casting; the pre-analysis of the furnace; the spectrum analyzer; chemical component

Synthesis of SiC Particulate Reinforced Aluminum Matrix Composites Using Stir Casting Method and Particulate Distribution Uniformity Investigation

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Abstract

The stir-casting method was used for fabrication of 20% volume fraction SiC particulate reinforced aluminum matrix composites. The relationship between stirring process parameters and the particle distribution uniformity is identified by changing process parameters: stirring temperature, stirring speed, and stirring time. The results show that the optimum particle distribution uniformity is achieved when the stirring temperature is 600℃, stirring speed is 600 r/min and stirring time is 30 min.

Key words: aluminum matrix composites; SiC particulate; distribution uniformity

一种将3D打印和精密铸造相结合的反重力成形技术

A New Counter Gravity Process combined with 3D print and investment casting

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摘要

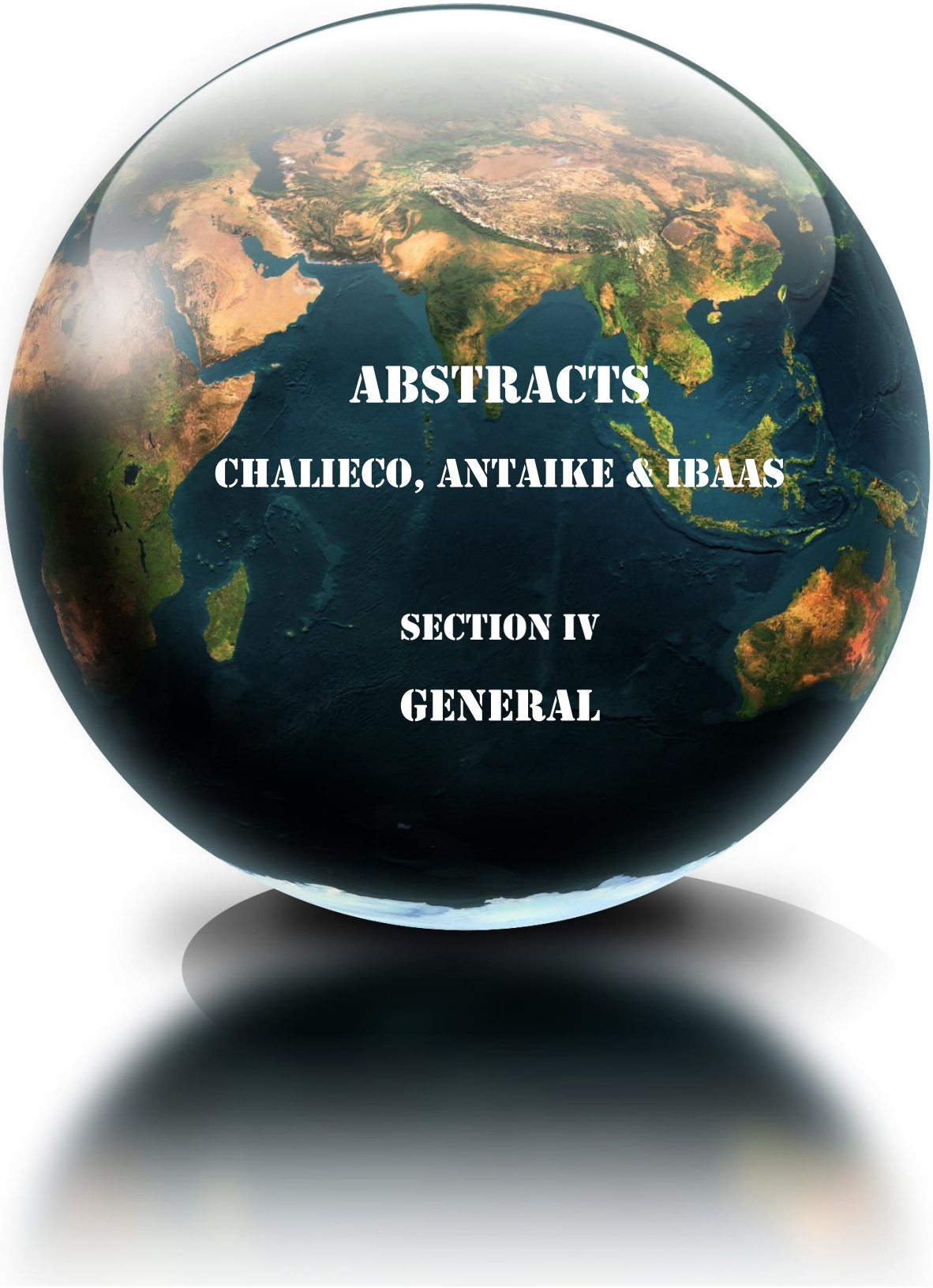
精密铸造，又称失蜡铸造，其特征是形状复杂，尺寸精确，而且通常壁厚很小。在生产上已经有采用低压铸造、差压铸造和真空铸造来成形的做法。本工作对这些方法作了评述，并提出了一种创新的浇注技术-调压成形精铸法，简称 CAP 方法（Cast under Adjustable Pressure）。为了铸造复杂的零件，将本技术与 3D 打印技术和精密铸造相结合，用很短的时间，就可以铸造出复杂的高精度铸件。

Abstract

Investment casting, usually also called lost wax casting, is characterized by intricate shape, very little dimension tolerances and in most cases, thin-walled cross section. In order to shape those castings, some counter gravity processes, such as low pressure, counter pressure and vacuum processes, have been used in foundry industry. In the present paper, some features of the present counter-gravity processes were reviewed and an innovative process called Casting under Adjustable Pressure (CAP) is proposed. In order to manufacture intricate aluminum castings, combination of CAP process with 3D print technology and investment casting has been employed in the present work. Thin walled aluminum casting of high integrity (local wall thickness as thin as 0.5 mm) can be made within a short time.

关键词：反重力，铝合金，3D 打印，铸造

Key words: counter gravity, aluminum alloy, 3D print, casting



ABSTRACTS

CHALIECO, ANTAIKE & IBAAS

SECTION IV

GENERAL

Dynamics of Global Aluminium Industry: China the Leader -Brazil, India and Russia On the fast growth path

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Abstract

Global aluminium industry has undergone sea changes over past four decades. The significant changes are geographical relocation of bauxite, alumina and aluminium production centres, consolidation of the industry, emergence of new markets, increasing threat from substitutes, upward shift in the industry cost curve etc. Besides these, global aluminium industry is suffering from historical decline in real prices. In the 1970's, over 45% of the global alumina production was concentrated in five industrialized countries poorly endowed with bauxite reserves – USA, Japan, Canada, France and Germany. The other producers were Australia (13%), USSR (12%), Jamaica (9%) and Suriname (6%). At present, only Australia continued to remain a major producer of alumina with alumina production base shifted to the bauxite producing regions. BRIC countries led by China now accounts for 53% of global alumina output. Major relocation took place in case of aluminium production also. In 1972, the share of USA, USSR and Japan in global aluminium production was 60% which declined to about 10% at present while China (with 39% share) emerged as the world leader. Global aluminium industry was dominated in the early 1970s by only six major players – Alcoa, Alcan, Reynolds, Kaiser, Pechiney and Alusuisse with their combined share then exceeding 60% for bauxite, about 80% for alumina and around 73% for primary aluminium production. With the arrival of new players like U C Rusal, BHP Biliton, Rio Tinto Alcan, Hydro Aluminium China Power Investment Corporation, Dubai Aluminium Company, Hindalco, NALCO, Vedanta Resources etc. characterized by horizontal integration, the share of original six players attenuated over the years. Presently, the industry is dominated by China. All these developments have taken place over four decades. China has emerged as the most prominent player in the global aluminium industry despite relatively low share (14%) in global bauxite production. China is the largest alumina producer in the world (35% share in global production) based on imported supply of bauxite (mainly from Indonesia). In primary aluminium production also China is a global leader with 39% share in global primary aluminium output. During the last decade, aluminium consumption in China has quadrupled. Post oil crisis, low entry costs in some parts of China has also provided impetus to growth of aluminium industry in China. On this backdrop, the present study has undertaken an in-depth analysis of the major shifts in global aluminium industry in terms of relocation, production, market concentration, price movements etc. and assessment of future outlook with special emphasis on China. The study arrived at the conclusions that the demand side as well as the supply side of global aluminium industry will be dominated by China, followed by Brazil, Russia, India, Middle East etc., market consolidation will be lesser, competition among industry groups likely to intensify and price volatility would persist, at least in the short-run.

Key words: alumina, aluminium, market, demand, supply

Application of Six Sigma Management Tool in Improving Inventory Accuracy

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Abstract

How to improve inventory accuracy is always a difficult problem, as well as a research topic. In this paper, the present inventory accuracy is stated, the reasons which influence inventory accuracy are found and analysed with quality management tool, and corresponding solutions are pointed out.
Key Words: Quality Management, Tool, Inventory, Accuracy

正确使用标准品改善铝工业分析结果

How to Use CRMS Correctly to Improve the Analysis Results in Aluminum Industry

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Abstract

Introduced the Certified reference materials in the Aluminum producing lines. What are CRMS, the types of the CRMS existed in the aluminum lines, and the CRMS producing and using, the CRM's certification and its expiration are discussed. The industrial lab analysis in the Aluminum lines-wet methods and instrument analysis and tell how to find the right CRMS to improve the analysis results in the aluminum industry are also presented.
Key words: CRMS RMS Aluminum analysis Alumina

推动铝加工消费市场，夯实铝加工产业基石

To Promote Aluminum Consumption Market, to Consolidate the Cornerstone of Aluminum Industry

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摘要

铝从开采的铝土矿石→提炼成氧化铝→电解铝冶炼→铝加工→铝制品是个复杂的专业分项的生产过程。从我们国家目前的铝工业产业链出现的“产能过剩”来看，中间的环节需要疏通。疏通的最好方式就是拉动终端产品的消费。本文有选择的分析了新兴市场和潜在的铝加工消费市场。

Abstract

Production of aluminum products is a complex professional breakdown process which is from bauxite mined → refined into alumina → electrolytic aluminum smelting → aluminum processing → aluminum products. In the view of "excess capacity" of our country's current aluminum industry chain, the intermediate links require to dredge. The best way to dredge is by stimulating consumption of end product. This paper has selectively analyzed emerging market and potential aluminum processing consumption market.

关键词：铝加工 应用领域 消费市场 铝深加工

Keywords: aluminum processing; application fields; consumption market; aluminum deep processing

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Thank you for making this event a grand success.

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Thanks a lot!

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