8TH INTERNATIONAL IBAAS CONFERENCE AND EXHIBITION

第八届IBAAS国际会展

IBAAS-GAMI 2019

Technological Advances in Alumina, Aluminium Smelter, Downstream Fabrication, Energy Conservation, Environmental Protection and Smart Manufacturing with Special Reference to China

氧化铝，电解铝，铝加工，节能环保及智能制造等技术进步-聚焦中国

SOUVENIR 会刊

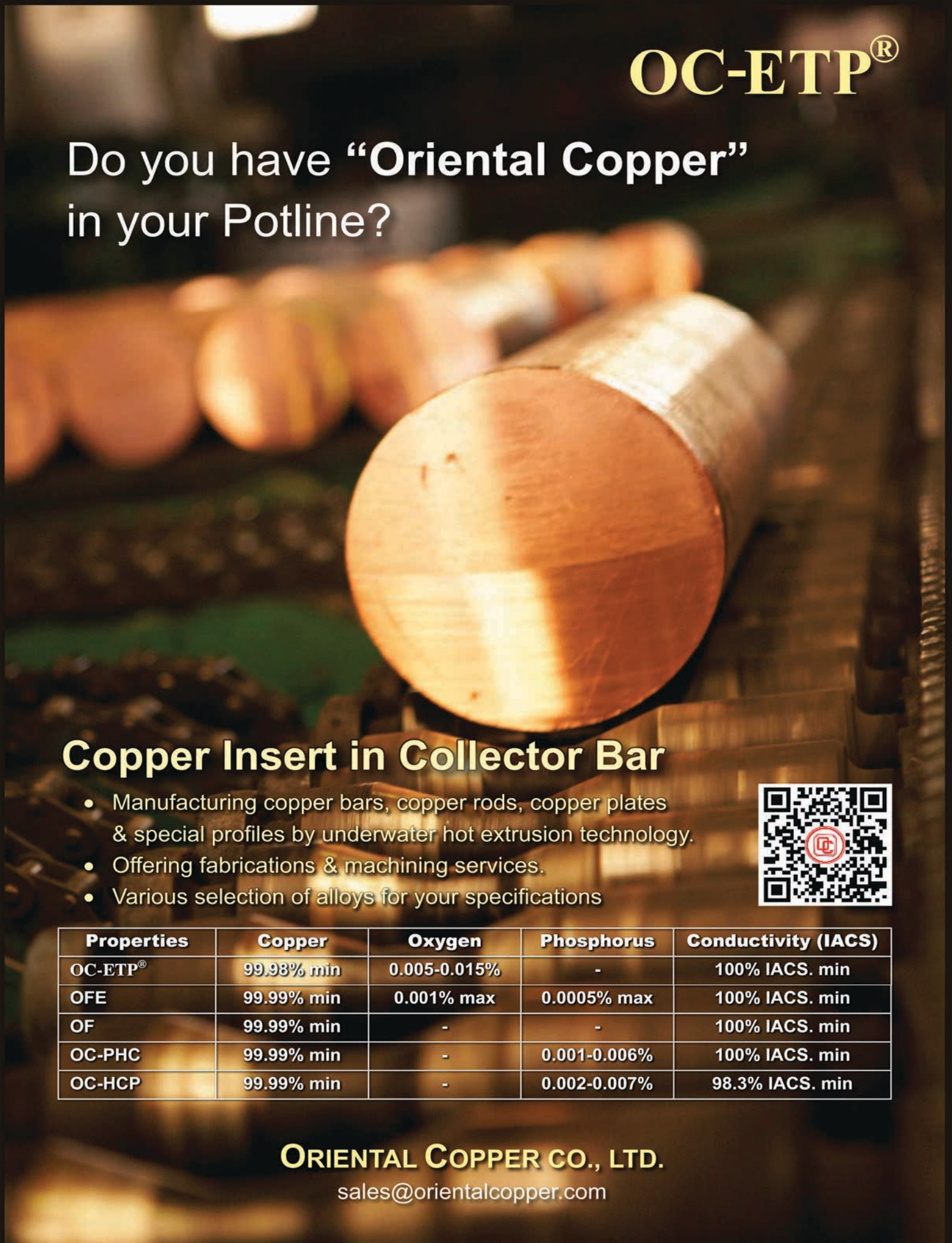
SEPTEMBER 4-6, 2019

RENAISSANCE GUIYANG HOTEL

GUIYANG, CHINA

2019年9月4-6日

贵阳万丽酒店 中国,贵阳



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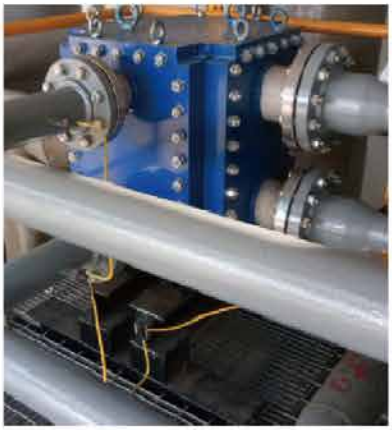


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On behalf of the organizing committee, it is our pleasure to welcome you in the 8th International Conference & Exhibition (IBAAS-GAMI 2019) on "Technological Advances in Alumina, Aluminium Smelter, Downstream Fabrication, Energy Conservation and Environmental Protection and Smart Manufacturing with Special Reference to China" in cooperation with Guiyang Aluminium & Magnesium Design Institute Co. Ltd. (GAMI) being held in Renaissance Guiyang Hotel in China during September 4-6, 2019.

About 80 abstracts of technical papers have been received from all over the world for this mega Aluminium event. Three technical sessions are planned for 8th IBAAS International Conference:
1. Bauxite-Alumina
2. Aluminium Smelting
3. Aluminium Downstream

Apart from above, there are some interesting presentations on Bauxite, Alumina and Aluminium industry of world with special reference to China. The Conference will also have an Exhibition related to aluminium industry and post-conference visits to modern alumina refinery, smelter plant and aluminium downstream facility of China are also organized.

We welcome you to this mega Aluminium technical event (IBAAS-GAMI 2019) of China and are confident that you all will be benefited by interacting with Alumina and Aluminium industry leaders, experts and professionals from all over the world participating in this International conference.

Best Regards,
Organizing Committee of IBAAS-GAMI 2019

在此我谨代表组委会，热烈欢迎各位莅临第八届“**氧化铝、电解铝、铝加工、节能环保及智能制造等技术进步-聚焦中 国**”国际会议暨展览（IBAAS-GAMI 2019）。此次会议暨展览为IBAAS与贵阳铝镁设计研究院有限公司（GAMI）于2019年9月4日至6日在中国贵阳万丽酒店联合举办。

组委会已经收到来自世界各地大约80篇技术论文摘要。此次IBAAS国际会议暨展览共设置如下三个分会会场：

1. 铝土矿-氧化铝
2. 电解铝
3. 铝加工

组委会届时将举办与铝工业有关的展览，并组织参会代表会后参观中国先进的氧化铝厂、电解铝厂以及铝加工厂。

我们热忱欢迎您参加本届在中国举办的IBAAS-GAMI 2019会议。届时通过与现场全球铝行业领袖、专家和专业人士的交流，我们相信您必将获益匪浅。

此致

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International Bauxite, Alumina & Aluminium Society (IBAAS) 国际铝土矿、氧化铝和铝协会简介

IBAAS is an organization formed by professionals active in various fields of Aluminium industry, with its roots in India/Asia.

IBAAS（国际铝土矿-氧化铝-铝协会）注册成立于印度，其创始人是活跃于铝行业各个领域的专业人士。协会宗旨如下：

The objectives of this society are:

- Provide platform for Bauxite-Alumina-Aluminium industry professionals to interact and network for the common goal and development of this industry.
  为铝行业专业人士提供交流平台，推动行业发展；

- Organize annual and bi-annual workshop, symposia and conferences in association with primary Aluminium producers, Engineering, R&D Institutes, Government organizations and local resource companies.
  每半年或一年一次与原铝生产单位、设计单位和研发单位联合举办小型讨论会、研讨会或大会；

- Promote latest technology and advertise products and equipment of aluminium industry.
  推广最新技术、宣传产品和设备；

- Publish papers, monographs and books to highlight latest achievements in the field.
  出版行业相关最新成果的论文、专著和书籍；

- Facilitate technology transfer and compile a list of experts available in the field.
  推进技术转让并将现有行业专家名录汇编成册；

The Society was established in 2012 and is committed to promote the development of Bauxite, Alumina and Aluminium industry in the World. The Society has since then organized seven International events in India, China and Guinea.

协会成立于2012年，旨在推动亚洲范围内铝土矿、氧化铝和原铝行业的发展。自成立以来，协会在印度、中国和加纳共举办了7届国际会议。详情如下：

IBAAS-2012: First International symposium of IBAAS on the topic "Bauxite, Alumina and Aluminium Industry of Asia – Vision 2020", December 3-5, 2012 in association with JNARDDC (Jawaharlal Nehru Aluminium Research Development & Design Centre) in Nagpur, India with a special emphasize on non-metallurgical bauxites and alumina products.

IBAAS-2012国际铝工业技术研讨会：IBAAS所举办的首届国际性会议，主题为“对亚洲铝土矿、氧化铝和原铝行业的未来展望2020”。会议于2012年12月3日至5日在印度那格溥尔举办。会议联合主办方为贾瓦哈拉尔尼赫鲁原铝研发设计中心（JNARDDC）。会议特别关注非冶金级铝土矿和氧化铝产品。

IBAAS-2013: Second International symposium of IBAAS on the topic "Present Status and Future Prospects of Bauxite- Alumina and Aluminium Industry of the World, with Special Reference to China", November 28-30, 2013 in association with CHALIECO (China Aluminum International Engineering Co., Ltd.) and ANTAIKE (Beijing Antaike Information Development Co., Ltd) in Nanning, Guangxi, China.

IBAAS-2013国际铝行业技术研讨会：IBAAS所举办的第二届国际性会议，主题为“世界铝土矿、氧化铝和电解铝行业现状和展望-特别关注中国”。会议于2013年11月28日至30日在中国广西南宁举办。会议

联合主办方为中铝国际工程股份有限公司和北京安泰科信息开发有限公司（安泰科）。

IBAAS-2014: Third International symposium of IBAAS on the topic "Technological Improvements & Market Developments in Aluminium Industry with Special Reference to Value Added Products of Bauxite, Alumina and Aluminium" in Visakhapatnam, India during November 27-29, 2014.

IBAAS-2014国际铝行业技术研讨会：IBAAS所举办的第三届国际性会议，主题为"铝工业技术进步和市场发展-特别关注铝土矿、氧化铝和原铝的高附加值产品"。会议于2014年11月27日至29日在印度维萨卡帕特南举办。

IBAAS-2015: Fourth International symposium of IBAAS on the topic "The Development and Future of Aluminium Industry in China - Reality and Dream" was organized in Suzhou, China during November 25-27, 2015 in association with CHALIECO (China Aluminum International Engineering Corporation Limited) and SINR (Suzhou Research Institute for Nonferrous Metals).

IBAAS-2015国际铝行业技术研讨会：IBAAS所举办的第四届国际性会议，主题为"中国铝工业发展和未来- 现实与理想"。会议于2015年11月25日至27日在中国苏州举办。会议联合主办方为中铝国际工程股份有限公司（CHALIECO）和苏州有色金属研究所（SINR）。

IBAAS-2016: The fifth IBAAS symposium on the topic "Aluminium Industry-The Evolving Asia-Pacific Story" was held successfully in Goa India during September 26 – 28, 2016. This International Symposium was jointly organized with The Indian Institute of Metals (IIM) and attracted more than 200 delegates from all over the world. The conference was organized closely in association with Indian Primary Aluminium Producers like HINDALCO, VEDANTA and NALCO.

IBAAS-2016国际铝行业技术研讨会：IBAAS所举办的第五届国际性会议，主题为"铝工业-不断演变的亚太故事"。会议于2016年9月26至28日在印度果阿举办。会议由印度金属研究所（IIM）联合举办，吸引了来自世界各地的200多名代表参加。会议与印度的主要铝生产商，即HINDALCO，VEDANTA 和NALCO密切合作。

IBAAS-2017: The sixth International symposium of IBAAS on the topic 'Sustainable Development of Bauxite & Alumina Industry in Guinea' was organized in Conakry, Guinea during September 21-22, 2017 in collaboration with CAMEN Resources. This was the first Bauxite-Alumina conference in Guinea and widely appreciated by participating companies, delegates and Government of Guinea.

IBAAS-2017国际铝行业技术研讨会：IBAAS所举办的第六届国际性会议，主题为"几内亚铝土矿和氧化铝工业的可持续发展"。会议于2017年9月21日至22日在几内亚科纳克里举办。会议联合主办方为喀麦隆资源公司。这是首次在拥有世界上最大铝土矿资源的几内亚召开这样一次技术会议，几内亚是目前矿业和出口业的中心。

IBAAS–2018: The seventh International symposium of IBAAS on the topic 'Indian Aluminium Industry status, Strategies & way forward for accelerated growth' was held in Mumbai, India during September 5-7, 2018. This International Symposium was organized in association with IIM (The Indian Institute of Metals), AAI (Aluminium Association of India), JNARDDC (Jawaharlal Nehru Aluminium Research Development & Design Centre) and ABSTCPL (The Aditya Birla Science & Technology Company Private Limited).

IBAAS-2018国际铝行业技术研讨会：IBAAS所举办的第七届国际性会议，主题为"印度铝行业的地位、战略和加速成长的道路"。 会议于2018年9月5日至7日在印度孟买举办。会议联合主办方为印度金属研究所（IIM）、印度铝协会（AAI）、贾瓦哈拉尔尼赫鲁铝研究开发设计中心（JNARDDC）和Aditya Birla科技有限公司（ABSTCPL）。

These seven International events were highly successful and evoked wide interest of Bauxite-Alumina & Aluminium industry and experts in the IBAAS symposium and conferences. In continuation of above seven conferences, this year IBAAS is organizing eighth International event (IBAAS-GAMI 2019) in Guiyang, China during September 4-6, 2019.
For further details please visit the IBAAS website ***http://www.ibaas.info/***

上述七届研讨会均圆满落幕，并引起了铝行业企业和业内专家的广泛兴趣。今年，协会将于2019年9月4日至6日在中国贵阳继续举办第八届年会-IBAAS-GAMI 2019国际铝工业技术研讨会。欲了解更多详情，请访问IBAAS网站 *http://www.ibaas.info/* 。

We welcome all the participating companies and delegates in this International Aluminium Conference & Exhibition in China. As indicated this conference is being organized in partnership with Guiyang Aluminium Magnesium Design & Research Institute Co. Ltd. (GAMI)/ Chalieco Guiyang Branch.

**我们热忱欢迎所有参会公司和代表参加本次在中国举行的国际铝会议暨展览会。
如上文所述，本次会议的联合主办方为贵阳铝镁设计研究院有限公司（GAMI）/中铝国际贵阳分公司。**

GUIYANG ALUMINIUM MAGNESIUM DESIGN & RESEARCH INSTITUTE CO., LTD. (GAMI)
贵阳铝镁设计研究院有限公司

Guiyang Aluminium Magnesium Design & Research Institute Co., Ltd. (GAMI), founded in 1958, a part of Aluminium Corporation of China (CHINALCO) and also a member of China Aluminium International Engineering Corporation Limited (CHALIECO), is one of the leading light-metal metallurgical design, engineering and scientific research units in China and Grade A company on non-ferrous smelting, architectural design and EPC contracting.

GAMI is currently employing over 1000 staffs, who are fully engaged in 32 disciplines as alumina, aluminium electrolysis, carbon, magnesium, titanium, automation & control, mechanical equipment, utilities engineering, environmental protection, civil engineering, project budgeting, etc. GAMI also have postdoctoral program and the National Al-Mg Electrolytic Equipment Engineering Technology Centre which are recognized by the Ministry of Science & Technology of China.

GAMI has closely associated with the Chinese aluminium industry and undertaken over 1000 various engineering projects in China and abroad. By the end of 2018, over 2800 patents have been applied, which enable GAMI to be the pioneer among domestic scientific research institutes. The proprietary technology has been successfully applied in India, Malaysia, Russia, Kazakhstan, Azerbaijan, Brazil, Greece, etc. achieving desired expectation and high market reputation.

**公司成立于1958年，隶属于中铝集团，是中铝国际的下属单位，是我国最具实力的轻金属冶炼设计科研单位之一，也是国家有色冶炼、建筑设计、工程建设总承包甲级单位。
公司现有员工1000余人，设置有氧化铝、电解铝、炭素、镁、钛、电气自动化与控制、机械设备、市政工程、环境保护、工程经济等32个专业。经国家科技部审批组建了“国家铝镁电解装备工程技术研究中心”和 “博士后科研工作站”。
公司与中国铝工业联系紧密，先后承揽了国内外1000多个各类项目， 2018年末，拥有2800项专利，确保公司专利申报名列全国两万多家科研院所前茅。专利技术已经应用在印度、马来西亚、俄罗斯、哈萨克斯坦、阿塞拜疆、巴西、希腊等国家，拥有良好的市场声誉。**

Associated Organizers of IBAAS–GAMI 2019

China Nonferrous Metals Processing Technology Co. Ltd., China (CNPT) is a subsidiary of CHALIECO and specializes in providing Engineering Solutions, Equipment and Technical Service for non-ferrous metals fabrication industry, especially for Aluminium Flat Rolling. It is certified for 13 Chinese national-superior design qualifications covering all aspects of non-ferrous metals fabrication projects. CNPT have two manufacturing bases to design and manufacturing equipment, including Hot Rolling Mill, Cold Rolling Mill, Finishing Facilities, Melting/Holding Furnace, Preheating/Homogenizing Furnace, Annealing furnaces, Environmental Protection System, Fire Fighting System, etc. It employs top Chinese talents in the field of non-ferrous metals processing industry to provide world-class high-quality solutions and equipment to the customers. CNPT has R&D centre in Suzhou focussing on researching new process, new equipment and new material application.

中色科技股份有限公司（简称“中色科技”）隶属于中铝国际工程股份有限公司，专注于提供有色金属制造业，特别是铝合金板材轧制的工程方案、设备及技术服务。公司通过13项中国国家优质设计资质认证，涵盖有色金属制造项目的各个方面； 拥有两个设计和制造设备的制造基地，包括热轧机、冷轧机、精加工设备、熔炼/保温炉、预热/均化炉、退火炉、环保系统、消防系统等。公司聘请中国有色金属加工行业顶尖人才，为客户提供世界一流的优质技术方案和设备； 公司在苏州设有研发中心，致力于新工艺、新设备、新材料的应用研究。

Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC) is an autonomous body under ministry of mines, Govt. of India. It is a “center of excellence” set up in 1989 as a joint project by Ministry of Mines, Government of India and United Nations Development program and fully functional since 1996. It was set up with a vision to create a state of the art research institute for the development of technologies and provide services to both primary and secondary aluminium industries with a special emphasis on environmental sustenance, energy and material conservation.

尼赫鲁铝研究开发设计中心（JNARDDC）为印度政府矿业部下属的自治机构。 机构是于1989年由矿业部、印度政府和联合国开发计划署联合设立的“英才中心”，自1996年起全面运行。其创立宗旨是创建一个先进的技术开发研究所，为原铝和再生铝行业提供服务，特别注重环保、节能和节材。

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- Jingjin Environmental Protection Inc., China
- Japan Aluminium Association (JAA)
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- Luyang Energy-saving Materials Co. Ltd., China
- Luoyang Vibration Machinery Co., Ltd., China
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- Oriental Copper ,Thailand
- Outotec (Canada) Ltd.
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- RIO TINTO
- RUSAL Engineering & Technology Centre, Ltd, Russia
- SAMI, China
- Sefar Filtration Solutions (Suzhou) Co. Ltd., China
- Shanghai AKW Separation Process Equipment Co., Ltd., China
- Shanghai Heat Transfer Equipment Co. Ltd., China
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BAUXITE-ALUMINA

Analysis and Prediction of Bauxite Production in Guinea

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ABSTRACT

This paper briefly introduces the current situation and development of bauxite resources in Guinea, lists the main bauxite projects planned or under construction in Guinea, and predicts the bauxite production in Guinea in the foreseeable future in combination with the global bauxite supply and the actual situation in Guinea.

Keywords: Guinea, Bauxite, Production, Prediction.

Ranking of World Bauxite Mines

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ABSTRACT

Bauxite mining is being carried out in about 20 countries in the world and at present Australia and Guinea are leading bauxite mining countries. This is followed by Brazil, India, Indonesia, Jamaica, Vietnam and China, which mainly consume ore for domestic alumina production. In the present paper, major bauxite mines of the world are evaluated and ranked according to following parameters:

- Bauxite Resources,
- Bauxite Thickness,
- Present Mining Capacity,
- Quality ROM,
- Quality Beneficiated Ore,
- Bauxite Mineralogy,
- Metallurgical Characteristics (Available Alumina & Reactive Silica),
- Infrastructure,
- Shipment Sizes / Alumina Plant, and
- Approximate Mining & Processing Cost.

Major bauxite mines of the world are evaluated based on the above given parameters and ranked on the scale of 10 marks. Only working bauxite mines are considered and in case of individual company whole lease hold area is taken into consideration. As trihydrate gibbsitic bauxite is considered best for processing to alumina by low temperature digestion process, these bauxite mines are ranked at the top.

Keywords: Bauxite Mining, Gibbsitic Ore, Bauxite Export, Alumina Production, Metallurgy, Infrastructure, Mining & Processing Cost.

Bauxite Beneficiation – Issues & Opportunities

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ABSTRACT

The main objective of bauxite beneficiation for metallurgical industry is to bring down the kaolinitic clay in the form of reactive silica and improve alumina content. Any reduction in iron, particularly in the form of Goethite, monohydrates like boehmite and organic contents are also welcomed for tri-hydrate Gibbsitic Bauxite. Bauxite for metallurgical industries belongs to one of the low value bulk ore group and therefore preference is given to simple beneficiation techniques such as crushing followed by dry screening or intense washing and scrubbing processes. In special cases, where long transportation and value addition of bauxite is required, more advanced processes may be deployed for metallurgical grade bauxite. The most effective way to remove both kaolinite and goethite is washing, followed by attrition scrubbing and removal of clay rich super-fines by hydro-cyclone. Metallurgical industry is quite sensitive to bauxite recovery and cost for processing of ore, particularly in wet beneficiation. On the other hand, owing to homogeneous nature and consistent quality, alumina refineries prefer the washed ore compared to simple crushed run-off-mine bauxite. The non-metallurgical industry can afford lower recovery and higher beneficiation costs, however, objective here is to bring down iron and titanium contents in bauxite and enhance alumina values. This requires more complicated processes like use of high intensity wet magnetic separator and fine grinding of bauxite to liberate the iron minerals. In some cases, reduction roasting followed by magnetic separation may be effective depending on chemical and mineralogical characteristics of bauxite.

Keywords: Beneficiation, Kaolinite, Reactive Silica, Boehmite, Goethite, Washing & Scrubbing, Reduction Roasting.

Design of Modern Bayer Alumina Refinery

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ABSTRACT

Firstly, this paper briefly reviews the origin of Bayer process and the development course of Bayer process alumina refinery, summarizes the purpose of construction of Bayer process alumina refinery, and then briefly summarizes the ways to improve the profitability of Bayer process alumina refinery from design, mainly in two aspects: reducing operation cost and saving construction investment; and clearly demonstrates that the most important things for less operation cost are site selection and production indicators optimization, and the main ways to save construction investment are correct site selection, reasonable general layout and appropriate equipment selection.

The author puts forward the concept of ideal Bayer alumina refinery and discusses how to design such a modern alumina refinery from eight aspects: site selection, general layout, product quality expectation, production process selection and determination of key technical indicators, selection of production equipment, control of construction investment, control of operation cost, and intelligent factory, and explains in details the most key aspect--site selection, and then discusses a little more on general layout and product quality.

At the end of this paper, the author makes it clear that the concept of modern Bayer process alumina refinery and the idea of how to design such an alumina refinery put forward in this paper are just some ideas that the author, as a common designer in alumina industry, has summarized from his own knowledge and experience, for sharing with everyone, and expecting to learn from everyone.

Keywords: Modern, Bayer Process, Alumina Refinery, Design, Site selection, General Layout, Product Quality, Construction Investment, Operation Cost, Intelligent.

Process Decision Making Using Marginal Cost Analysis

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ABSTRACT

Small differences in alumina refinery operation can have a significant impact on bottom-line profit. The marginal cost for extra tonnes of production is generally very different than the average cost. It can be much higher or lower depending on circumstances and more production may not always mean more profit. The differences are due to raw materials and energy usage (RME) which does not scale linearly with production. Analysis of marginal costs can highlight the impact of small changes to a process and address what are effectively economic bottlenecks in plant design, operation and capital projects. The analysis can give a true value for lost opportunities including production shortfalls, missed maintenance or non-optimized operation. Equipment condition and availability can be analysed and the results used to guide the allocation of maintenance resources to minimize production costs.

Alumina refineries have recirculating flow with many recycle loops. This means that any change anywhere in the process will affect the everything in the entire process to some extent. The marginal cost is the sum of all the differences in RME across the plant divided by the difference production. These differences are often small and are difficult to measure accurately in a controlled manner in an operating plant. It is virtually impossible to isolate and measure the effects of small changes on a process. The analysis must be done based on a comprehensive process simulation model of the plant combined with a financial cost model. A well-tuned plant model will give accurate information about the relative differences in raw materials and energy between different proposed designs, projects or operating targets. Scenarios may also include variations in individual equipment performance and availability that can be used to build an equipment sensitivity matrix. The model RME utilizations for

different scenarios are input to the cost model that includes also detailed fixed and variable operating costs. Comparison of scenarios with a base case scenario will give accurate marginal cost information. This method of analysis gives a true measure of the bottom-line impact of equipment condition, process changes and proposed capital improvements. This information can be used to select appropriate technologies and allocate limited resources to minimise production cost within real constraints. It is one of the proven tools in refinery management and in mature plants has allowed for continual production increase and cost reduction without major capital expenditure. This presentation will focus on examples of processing diasporic Bauxite typical of Chinese plants.

Key Words: Alumina refinery operation, Marginal cost, Process simulation, Cost model, Diasporic Bauxite, and Chinese plants.

Research on Advanced Process Control System in Alumina Roasting Process

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ABSTRACT

At present, the control of the process parameters of the roasting process mainly relies on artificial judging, such as, the amount of aluminum hydroxide feeding, the opening of the natural gas valve, and the opening of the blower valve according to the temperature in the roaster and the changing speed of the temperature in the roaster. There are problems such as strong artificial experience, high energy loss, and unstable product quality. In this paper, the advanced process control system of alumina roasting process is discussed. The effects of aluminum hydroxide feed, the opening of the natural gas valve adjustment and the opening of the blower valve adjustment on the roasting process are explained and the automatic control by means of informatization is discussed. The purpose is to achieve optimal control of the roasting process parameters.

Keywords: Aluminum Hydroxide, Alumina, Roasting Process, Advanced Process Control, Roaster Temperature.

An Attempt of Combining Digestion and Evaporation in the Gibbsite Bayer Process

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ABSTRACT

Bayer process is adopted world-wide for the extraction of alumina from the bauxite ore for its lower energy consumption and reasonable alkali liquor process in modem alumina industry's development history. It's more than 100 years old, the main theoretical principle of Bayer process remains its classic status with almost no change, but some improvement of the equipment technique, sub-process optimization always is in progress. In the metallurgical chemical process, it's a really meaningful to find ways for lower energy consumption, high efficiency and more brief process because we can cut the cost down and make the refinery higher performing. In this article, the attempt will be done that the traditional digestion unit and evaporation into one unit will be combined, make into one unit, and moreover the whole Bayer process will be more brief and more efficient.

Keywords: Bayer Process, Equipment Technique and Process Optimization, Combination of Traditional Digestion and Evaporation Units.

Development of High Temperature Tube Digestion Technology for Bauxite

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ABSTRACT

The Bayer process for leaching bauxite with caustic soda to produce aluminum oxide and the Hall-Héroult process for the extraction of aluminum using fused-salt electrolysis were decisive in providing the basis in 1888 for the production of aluminum on an industrial scale. Aluminum production is still based on these processes today.

In the beginning, the introduction of these technologies was somewhat slow; there was a lack of suitable production equipment and a lack of markets for aluminum.

Increased aircraft production resulting from the First World War created new demand and forced production to follow suit. This article describes the development of alumina production technology. The Tube Digestion Technology for processing monohydrate bauxites at high-temperatures, which Vereinigte Aluminium Werke A.G. (VAW) brought into industrial production as long ago as 1956, is now used in numerous modern alumina plants.

Keywords: Tube Digestion Technology, Monohydrate Bauxites, High-Temperatures, Alumina Plants.

Changing Dynamics of Caustic Soda Market in Indian Subcontinent and Southeast Asia

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ABSTRACT

A large population in India subcontinent and southeast Asia together with their rising incomes is creating demand growth for caustic soda. India with it's large population growth is generating demand for many end uses of caustic soda. End uses such as textiles, alumina refining, soap detergent, etc. are supporting chemical manufacturing including refining capacity.

In southeast Asia growing population is also creating demand growth for caustic soda. Natural resources availability such as pulp and bauxite availability is creating more manufacturing facilities including more demand for caustic soda.

However, limited ethylene availability is challenging the balance of chlorine and caustic soda. India subcontinent's import will continue due to the increasing demand. The ongoing imbalance in Australia and the demand increasing in southeast Asia are accelerating the imbalance.

Without vinyl downstream demand, the chlorine and caustic soda continues to be imbalance in India and cabotage law neutralize the domestic advantange for freight and pits the imports against domestic supplies.

Growth in Southeast Asia continues to drive demand and imports of caustic soda. How has demand and supply affect the balance in this market? How will trade looks like in the future? The paper addresses these concerns.

Keywords: Caustic Soda, Chlorine, Demand and Supply.

Aluminium Hydroxide Precipitation Yield – Role of Hydrogen Peroxide and Hydrazine Hydrate

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ABSTRACT

In Bayer precipitation process sodium aluminate solution is decomposed to obtain aluminium hydroxide (ATH) while liberating sodium hydroxide into the solution. The productivity of the alumina trihydrate is an important parameter determines the efficiency of a plant. Therefore, there is a scope to

enhance the aluminium hydroxide precipitation yield up to the maximum level of equilibrium solubility limit. In the present study hydrazine hydrate and hydrogen peroxide were used to study their behaviour in increasing the yield of ATH in sodium aluminate solution. Hydrazine hydrate is a colourless liquid with ammonia like odour. It is a weak base. Hydrogen peroxide is also a colourless liquid and highly oxidizing agent. A simple set of experiments with synthetic solution were carried out to find their role in enhancing the aluminium hydroxide precipitation. The presence of either hydrazine or hydrogen peroxide in the sodium aluminate liquor was found to be effective in improving the process of precipitation substantially. Lower amount of hydrazine of 24–40 mmol/L was beneficial whereas higher dose of about 350 mmol/L was required for a significant yield enhancement in the case of hydrogen peroxide. The scanning electron micrographs (SEM) showed agglomerated products with hydrazine hydrate but fine discrete particles were obtained with H_2O_2 addition. In all the cases ATH obtained was gibbsitic in nature. The mechanisms of enhanced yield that take place while adding the additives was also studied which will be deliberated along with liquor productivity in the paper.

Keywords: Hydrogen peroxide, Hydrazine hydrate, Agglomerated products.

Increased Flow Rate and Reduced Filtration Cost by Using Scale Retardant Filter Technology for Bayer Liquor Clarification

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ABSTRACT

Alumina pregnant liquor clarification is carried out in horizontal and vertical pressure leaf filters. In dependence of bauxite composition and conditions of digestion, scale containing different elements can crystallize on the filtration equipment. The scale reduces volume of tanks, flow in pipes and throughput of filter media. In order to maintain the flow rate through the filter media, a regular caustic cleaning is performed. However, despite cleaning cycles, an unavoidable reduction of liquor flow is observed from cycle to cycle. Eventually, scale growth reduces the flow rate to a minimum value that triggers the need for filter refurbishing. For plants, which experience bad control of flocculation, it can instantly clog the filter media and decrease the flow. This requires a rapid replacement of filter bags, since the combination of flocculent and scale makes the flow recovery almost impossible. Sefar x-Scale filter media technology was developed with the aim to delay scaling on the filter bag surface during clarification operation. The solution come from combining optimized spinning parameters with an improved yarn formulation and from using EPDM components for filter bag manufacturing. The results presented in this paper show the liquor flow rate achieved with x-Scale filter media is more constant and decreases slower when compared to conventional filter bags. The improvement of flow, along with the service life increase, provide a reduction in filtration cost. This paper describes the approach and field achieved, using Scale retardant filter technology.

Keywords: Bayer Liquor Clarification, Pressure Leaf Filter for Alumina, Sefar X-Scale Technology Scale Retardant Filter Media.

Progress in Research on Preparation of High Purity and Ultrafine α-Al_2O_3

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ABSTRACT

High purity and ultra-fine alumina is widely used in high-tech manufacturing fields such as electronics, machinery and optics because of its unique and excellent properties.

In this paper, the methods of preparing high purity and ultra-fine alumina are summarized and comparatively analyzed, which points out the way of researching and producing high purity and ultra-fine alumina.

Keywords: Alpha Alumina, High Purity and Ultrafine Alumina.

Indian Bauxite Residue: Studies on Potential Resource for Rare Earth Elements

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ABSTRACT

Bauxite residue is a process reject of Bayer's process during alumina extraction. Rare earth elements (REE) are enriched in the bauxite residue during process which are substantial and a potential resource for recovery of REEs. Scandium is the most valuable metal among the REEs present in the bauxite residue.

In the present paper, detailed chemical characterization, techniques of physical beneficiation such as sieving, hydrocyclone, multi-gravity separator (MGS) have been discussed, subsequently leaching with different mineral acids for the selective extraction of REEs has been presented. Various experimental parameters (such as acid concentration, solid/liquid ratio, temperature and leaching time) were studied.

Indian bauxite residue assaying ≈ 200 mg/kg REEs (Sc, La and Ce) and Fe_2O_3 (37.5%) was subjected to beneficiation studies to enrich the concentration of REEs present in mud. Detailed beneficiation studies reveal that it is achievable to a fraction with >250 mg/kg with reduced Fe_2O_3 content (27.5%). The weight recovery of 70% was achieved with set parameters on MGS. Further, experiments conducted on beneficiated mud was found to have higher REE leaching percentages with lower iron co-extraction.

It was observed that under optimized condition the leaching efficiencies for Sc, La and Ce were >60%, 75% and 90% respectively. Leaching with 1-2M H_2SO_4, S/L ratio of 1/20, temperature of 95-100°C and leaching time of 2 hrs was found to be the most promising leaching condition for these elements.

Extraction and separation of REEs from the leach liquor using D2EHPA as an extractant are being investigated. So far, the preliminary tests indicate encouraging results and further studies are under progress for optimization.

Keywords: Bauxite Residue, REEs, Characterization, Beneficiation, Leaching, Extraction.

Efficient Bauxite Residue Processing with East Coast Bauxite of India

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ABSTRACT

With the ever-decreasing quality of Bauxite being processed in Bayer plants and the drive for increasing production, the stress on the mud circuit of modern plant is greater than ever. To facilitate the same, modern day thickeners have evolved from the earlier conventional settling tanks to the high rate decanters (HRD) and deep cone washers (DCW). These high rate decanters and deep cones meet the objective to process residue with high compaction, with minimal residence time in order to improve the separation efficiency.

Usage of synthetic polymers enhances the solid–liquid separation. Choosing a right flocculant for the regional bauxite to be processed, enables reduced variations in the circuit. Customized flocculant application is imperative to achieve the desired settling rate for a compact underflow and clear supernatant liquor.

At UAIL (Utkal Alumina International, Ltd), the Indian east coast bauxite (Baphlimalli Mines) is digested at medium temperature to extract alumina and the bauxite residue is processed through a Counter Current Decantation (CCD) circuit consisting of 2 HRD's and 6 DCW's before the residue is dry discharged to the residue disposal area via Pressure Filters.

This paper highlights the efficient bauxite residue processing at UAIL, by debottlenecking the mud circuit to enable processing of low THA (Tri-hydrate alumina) bauxite (than design) specification. Substantial gains were achieved in terms of sustaining higher production rates, reduced chemical soda losses and optimal flocculant consumption. The paper also describes the impact of introducing dry residue disposal and management for the refinery.

Keywords: Bauxite Residue, Bayer's Process, Decantation, Flocculant, Tri-hydrate Alumina & Pressure Filtration.

A Large-scale Application for Bauxite Residue in Association with Portland Cement: Impact of Kind and Content of Residue

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ABSTRACT

Brazil has the third largest bauxite deposit on the planet, is the fourth largest producer of alumina and the fifth country in the exportation of primary aluminum or alloys. Accompanying the advancement of aluminum industry, the generation of waste is growing up worldwide, and the search for applications for bauxite residue (BR) has gained strength, because more than 98% of the waste is still disposed in the lakes of mud, causing considerable environmental impact. At the same time, maintaining the current practices of high cement consumption associated to the gradual reduction of the availability of natural resources, it is expected an increase in the CO_2 emissions in the next years, while the world target for greenhouse gas emissions needs to be decreased up to 2050. So, a strategy needs to be considered for improving the amount of supplementary cementitious material (SCM) used in compositions of concretes and mortars, as the known SCM are finite. At this way, the partial replacement of Portland cement by BR can be a way to find a large-scale application for the waste and can help to reduce the CO_2 released during the binder production. The main goal of the work was to evaluate the impact of using BR, collected from different sites in Brazil, on the development of microstructural formation and in the hardened state properties of Portland cement compositions. Pastes were prepared with replacements of 5, 10 and 20% of BR, and the fluid-to-solid transition was monitored using rheological tests and isothermal conduction calorimetry. After cure for 28 days, changes in the split tensile strength, modulus of elasticity, air-permeability, and alkalis leaching were evaluated. Results show that, the gain on consistency during the fluid-to-solid transition, and the hardened state properties were directly related to the kind and content of bauxite residue. Additionally, it is possible to infer that this association can be done without losses in the hardened state properties, resulting in improvements in the environmental issues in the chain of cement and bauxite residue. However, this association must be assessed on a case-by-case basis, because the physicochemical interaction between them depends on the different characteristics of cement and residues.

Keywords: Bauxite Residue, Portland Cement, Large-Scale Application, Leaching.

Discussion on Wastewater Treatment and Reuse in Alumina Plant

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ABSTRACT

This paper analyzes the origin of wastewater from alumina plant and the pollutants contained in the wastewater. According to the quality of the incoming and outgoing wastewater, the object of reuse after wastewater treatment and a wastewater treatment process are given. The wastewater is treated by this process and reused and can reduce the pollution of the surrounding water environment, reduce the consumption of production water and reduce the cost of production and operation.

Keywords: Wastewater from Alumina, Quality of Wastewater, Wastewater Treatment Process.

Brief Discussion on Long-Distance Pipeline Transportation Design of Red Mud Slurry

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ABSTRACT

In the design of red mud slurry long distance pipeline transportation, the solid content of red mud slurry, the transportation equipment, the material of pipeline is selected according to the transportation distance and natural conditions. After the economic analysis of the design scheme, the final scheme is determined. On the basis of side-stream in alumina production by Bayer process, the advantage and disadvantage of different transportation under different external conditions are discussed, from the perspective of functional reliability, economy, and operability.

Keywords: Red Mud, Long-Distance Transportation, Pipeline.

Study on the Application of HAZOP in Risk Assessment of Red Mud Filtration

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ABSTRACT

Hazard and Operability (HAZOP) study is a risk assessment method for identifying hazard sources, analyzing the consequences and proposing corresponding mitigation measures. Currently, it is widely used in China's petrochemical industry. This paper introduces its analysis procedures and discusses the necessity and feasibility of its application in the alumina industry. Taking the red mud filtration as an example, HAZOP is an effective method to improve the safety evaluation of the alumina industry.

Keywords: Hazard and Operability (HAZOP), Red Mud Filtration, Risk Assessment.

The Stability Analysis of the Eccentric Load on the External Wall of Large Tank

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ABSTRACT

This paper is combined with theoretical analysis and finite element simulation, building 3D model in Solid Works, analysis of Desilication Tank with different eccentric loads on the same wall thickness and different wall thickness under the same eccentric loads through ANSYS Workbench, get the stress and deformation characteristics of Desilication Tank under eccentric load, provide a reference for large tank that subjected to eccentric loads.

Keywords: Solid Works, ANSYS Workbench, Eccentric Load, Desilication Tank.

ALUMINIUM SMELTING

Alternate Options to Growth of Primary Aluminium Industry in India and Other Developing Countries

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ABSTRACT

The last two decades witnessed setting up of large sized aluminium projects coupled with coal/gas based captive power plants in India and the Middle East. The Capex outlay for such large projects is around ~ $1.5-2 billion, and also saw successful development of high amperage pots (300-500kA) ideal for such large sized smelters. These mega projects require large tracts of land and large outlay of Capex, besides timelines of 5-7 years from concept to commissioning.

In order to meet the rising demand for primary aluminium in India and other developing countries, it is, therefore, necessary to encourage development and installation of mid-sized energy efficient smelters of capacities ranging from 50-150 kt/yr with power drawn from the national grid/Independent Power producers. This will significantly increase the supply of primary aluminium in the developing and third world countries. The Capex outlay can be significantly lower from $60 - 100 million onwards based on the location and configuration.

Other key raw materials like prebake anode and alumina can also be purchased through long term supply contracts.

By installing mid-size energy efficient smelters, downstream aluminium producers will also benefit in increased supply. Such smelters can also serve as effective facility for recycling of aluminium scrap, since with hot metal availability the melt loss can be reduced.

Keywords: Low Capex, Mid-Size Smelters, Energy Efficient, Cater to Specific Markets.

Research on Intelligent Mobile Digital Assistant System for Aluminum Electrolysis

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ABSTRACT

This article briefly introduces the actual production role of intelligent mobile digital assistant in the aluminum industry, describes the overall structure of the system, and develop the development many as AL-SPDA operating system, production information viewing, pot information viewing, pot patrol, operation standards, production cooperation, unattended mobile alarm and remote anode current detection control to effectively improve the work efficiency and reduce the work intensity of enterprises.

Keywords: Intelligent Mobile Digital Assistant, Unattended Anode Current Detection, Aluminum Electrolysis.

One Kind of Intelligent Crust Breaking Control Device and Method for Aluminium Electrolysis Production

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ABSTRACT

The first generation of the MPPIC technology of the CHALIECO GAMI had been developed over 10 years up to now. Every respect concerning this technology had been improved and upgraded a lot during these years. With this technology selected by the domestic and overseas aluminium smelters for all kinds of the larger and super larger aluminium reduction pot's technology, a big progress had been made of their technical performances & economic indexes together. Based on the third generation of the MPPIC technology, the new study and application of intelligent alumina crust breaking and feeding device has been innovated. It will create better conditions and foundations not only for alumina concentration distribution and anode effect intelligent control, but also for the stable operation and further good performance of the larger aluminium potline production.

Keywords: Aluminium Reduction Pot, MPPIC Technology, Pot Controller, Intelligent Crust Breaking Control Device.

Study on the Main Process Parameters 530 kA Aluminum Electrolysis Cell and Calculation of Electrothermal Field Simulation

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ABSTRACT

With the gradual enlargement of aluminum electrolysis cell (AEC), the heat balance of AEC plays a very important role in the process of aluminum electrolysis production. The simulation study on the thermal field of AEC can guide the design of AEC and the determination of production process conditions, improve the current efficiency and increase the life of AEC. At the same time, the technological parameters in the production process have a great influence on the electrothermal field. This paper studies and analyzes the influence of superheat, aluminum level, covering material thickness on the production process of AEC. According to the actual production experience, the calculation boundary conditions of the electrothermal field are determined, the electrothermal field of 530kA AEC is

simulated and calculated with ANSYS and finite element methods to form balance parameters for stable operation of 530kA isotherm optimized AEC, which provided theoretical guidance for the efficient and stable operation of AEC in the actual production process.

Keywords: 530ka Aluminum Electrolysis Cell, Process Parameter Analysis, Electrothermal Field.

Discussion on Application of Cathode Ferro-Phosphorus Casting Technology in Aluminum Electrolysis Cell

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ABSTRACT

In this paper, the energy saving effect of cathode ferro-phosphorus casting technology in aluminium reduction cell, the problems encountered in the process of casting and the experience gained are discussed. Combined with production practice, the problems often encountered in cathode ferro-phosphorus casting, the advantages of cathode pressure drop of ferro-phosphorus casting and the advantages of cathode electrolytic cell index of ferro-phosphorus casting are analyzed in detail, which will provide a reference for the application of ferro-phosphorus casting technology.

Keyword: Aluminum Electrolysis Cell, Cathode Ferro-Phosphorus Casting, Bottom Voltage, Cell Voltage, Current Efficiency, Cell Life.

Design of 500 kA Large Aluminum Reduction Cells

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ABSTRACT

This paper introduces the design idea of 500 kA large aluminium reduction cell. Busbar design adopts a new type of anti-disturbance and current-stabilized bus configuration technology, which solves the disturbance problem of upstream and downstream cell when the cell is unstable in production process, and greatly improves the stability of end cell. The lining design adopts double-balance cell technology, adopts regional thermal insulation, optimizes the lining structure, and makes the cell form a good furnace side shape. The cell shell adopts the integral welding technology of right-angle shell, which improves the stress concentration obviously and reduces the deformation of shell. Compared with the test and production data, the production and design form a closed loop, which supports the design.

Keywords: Aluminum Reduction Cells, Busbar Design Cell, Cell Lining, Cell Shell.

Analysis and Research of the Top Heat Dissipation of the Aluminum Electrolytic Cell

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ABSTRACT

The energy balance is the key to the smooth operation of the aluminum reduction cell and it is also the key to the energy saving of the aluminum reduction cell. The heat dissipation of the upper part of the aluminum reduction cell is mainly the heat dissipation of the cell cover and the upper structure. According to statistics, the heat dissipation of the upper part of the cell is about 1V, accounting for about 55% of the total heat dissipation. Through the analysis of the upper heat dissipation and the theoretical calculation of the upper heat dissipation when the external conditions change, the characteristics of the upper heat dissipation are studied. It can be seen from the simulation results that the sealing and insulation of the aluminum reduction cell and the adjustment of the covering material can reduce the heat dissipation in the upper part of the cell, but the reduction is limited. The flow of the flue gas and the performance of the covering material are the core of the upper heat dissipation. On the basis of the simulation results, the improvement of reducing flue gas flow rate and the optimization of covering material were carried out, and the industrial test was carried out. The upper part of the test aluminum reduction cell heat dissipation to below 0.7V, for the aluminum reduction cell energy saving and consumption has opened wide space. This study will provide theoretical support and data reference for reducing the upper heat dissipation and the energy saving and consumption reduction of the aluminum reduction cell.

Keywords: Aluminum Electrolysis Cell, Upper Heat Dissipation, Theoretical Calculation, Energy Balance.

Production Practice and Discussion of Special-shaped Cathode Aluminium Reduction Cell

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ABSTRACT

This paper mainly discusses the energy-saving effect, problems encountered in production and experience gained in the production of special-shaped cathode electrolysis cell, focuses on the production practice of roasting start, daily maintenance operation, local cathode bump falling off, and gives optimization suggestions on the design of special-shaped cathode electrolysis cell.

Keyword: Special-Shaped Cathode, Roasting Start, Daily Maintenance, Bump Fall Off, Optimization.

RUSAL'S Resource-Saving Technologies

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ABSTRACT

Resource saving is a determining factor in reducing the aluminum production cost. For the purpose of reducing the aluminum production cost, UC RUSAL has developed both cost-effective/low-cost and high-cost technical solutions. All of these solutions have already been tested on pilot cells, and many of such solutions have been deployed across several pot lines.

The Energy-Saving Cell Designs project uses a two-way strategy. The first way is related to increasing energy efficiency by means of cost-effective solutions (energy-efficient lining designs, and efficient alumina feeding & voltage control algorithms providing for a low ACD, etc.), low-cost solutions (longer anodes with a 4-stub anode rod, steel-copper collector bars, etc.) and high-cost technical solutions (energy-efficient anode beams, new or upgraded bus bars, etc.) The second way is related to reducing cell relining expenses by using un-shaped lining materials with lignite semi-coke. Such materials help significantly reduce the cost of lining the sub-cathode zone, providing for the possibility of having at least 80 percent of lignite semi-coke recycled.

The above technical solutions have already been applied to different types of pre-baked cells at the Krasnoyarsk, Sayanogorsk and Irkutsk aluminum smelters.

Keywords: Resource Saving, Cost Effective/Low-Cost Solutions, High-Cost Technical Solutions, Un-Shaped Lining Materials.

STARprobe™: The New Standard for Measuring Critical Bath Properties

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ABSTRACT

The efficiency of aluminum smelting cells relies on sophisticated control in maintaining cell's thermal and material balances by regulating resistance, bath chemistry, and alumina feed. A good control of the cells is dictated by reliable and accurate measurement of key cell's operating parameters, i.e. cell (bath) temperature and electrolyte chemistry.

A few years ago, STAS introduced to the aluminum industry the STARprobe™ technology, a state-of-the-art technology developed and perfected by Alcoa. Packaged as a portable device, STARprobe ™

takes real time measurements of bath properties such as Superheat, Temperature, Alumina concentration and bath Ratio (or AlF_3) (STAR) in electrolysis cells.

All through the years, Alcoa confirmed that the synchronicity of measurements given by STARprobe™ is of the most important steps forward in improving the control and efficiency of electrolysis cells. The significance of the gains led Alcoa's plants to set STARprobe™ as their new standard way for measuring bath properties, with a worldwide deployment in their facilities. Now, through STAS, STARprobe™ is gaining more and more acceptance in other aluminium producers and sets itself as the reference, enabling significant gains in cells efficiency.

Keywords: Starprobe Technology, Measurement of Bath Properties, Electrolysis Says Efficiency.

Burning Calculation and Analysis of Open Ring Baking Furnace

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ABSTRACT

In this paper, the prebaked anode is used as an example, and burning calculation and analysis are conducted for the open ring baking furnace. A conclusion is drawn that the three main heat sources of baking furnace are natural gas burning, volatile burning and fill coke burning loss. The volatiles burning is the first heat source, and as a supplemental heat source, the natural gas burning is the second heat source. According to the comparison of calculated and measured flue gas component and volume of flue gas of baking furnace, it can be seen that the amount of flue gas produced in actual production is much larger than the calculated value. In addition, we can infer that there is a serious leaking problem of furnace that is the reason of higher fuel consumption and lower heating efficiency. The problem can be solved by the way of improving the seal property of furnace.

Keywords: Open Ring Baking Furnace, Burning Calculation, Amount of Flue Gas.

Development and Application of Gp500 Energy Saving Cell

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ABSTRACT

Aluminum smelters are always seeking opportunities to increase capacity and reduce energy consumption to survive in today's brutal competition. Nowadays, 500kA reduction cell technology becomes the first choice of a greenfield smelter due to its safety and good performance. As a technology provider, GAMI (Guiyang Aluminum & Magnesium Design & Research Institute Co., Ltd.) never stopped

the pursuit of developing an energy saving cell. This paper focuses on technical developments of GP500 energy saving cells, and introduces its industrial performance.

Keywords: Aluminum Reduction Cell, Energy Saving, Shell, Lining, Busbar, MPPIC, RDTS.

The Cathode & Cathode Lining Failure Effect to the Pot Life for Larger Capacity CWPB Pot

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ABSTRACT

With increasing number of larger capacity central-working prebaked (CWPB) pots are being deployed in the primary aluminum industry, the cathode life of the CWPB pot-lines will affect the economic & ecological performance more seriously. In this case, to prolong the pot life for the larger CWPB pot-lines is becoming one of our first prior and urgent works now.

Based on the basic effects of the CWPB pot cathode lining engineering, cathode materials & quality on the cathode life, the paper presents a detailed cathode failure investigation and analysis example of one 500kA pot-line in China domestic smelter. The cathode failure causation and precaution methods have been discussed at the end.

Keywords: Pot Line, Pot Lining Engineering, Cathode, Raw Material Quality, Pot Life.

Effect and Intelligent Solution of Breaker Jam & Elephant Leg Issues for Aluminium Reduction Pot

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ABSTRACT

Breaker jam & elephant leg are the most commonly-seen troublesome issues in aluminium reduction production, which have brought many negative consequences to pot management and economic & technical index. In this paper, reasons for breaker jam & elephant leg have been analyzed theoretically, and the relationships between the two have been discussed. Also, factors that may lead to the issues, like aluminium reduction superheat, breaking duration time, breaking depth in bath have been testified. In additional, the paper introduces a high-effective and low-cost intelligent solution which is being used in many Chinese smelters with satisfied effects: breaking times are lowered by 30%, sludge and AE frequency are reduced and energy consumption are saved.

Keywords: Breaker Jam, Elephant Leg, Aluminium Reduction Pot, Intelligent Solution.

Test and Analysis of Adjustable Shunt Device for Aluminum Electrolytic Cell Roasting

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ABSTRACT

The field test was carried out for a new adjustable shunt device with lower cost than the automatic splitting device of the aluminum electrolysis cell. The data such as the change of the cell voltage, the initial split flow, and the temperature change of the splitter were analyzed. The results show that the roasting shunt device can meet the requirements of the roasting start of the aluminum electrolysis cell, and has the ability to switch on and off, and can be safely installed and disassembled online and avoids the phenomenon of sparking.

Keywords: Aluminum Electrolytic Cell, Field Test, Roasting Shunt, Safety.

Full-Process Precision Management Direct Production of 3N Molten Aluminium on the Aluminium Electrolysis Cell

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ABSTRACT

This paper studies on the background that through interior full-process precision management, our plant improved process and site operation so as to directly produce 3N primary aluminum on the electrolysis cell without putting increased investments. This paper also elaborates the methods like reducing iron content in alumina and anode, improving covering material operation and process condition, all of which can contribute to high-grade primary aluminum and eventually realize the target of transformation and upgrading to production of high-grade primary aluminum.

Keywords: Full-Process, Precise Management, Electrolytic Cell, 3N Aluminum.

Continuous Developments in Cathode Lining of Low Amperage Pots to Improve Pot Life and Energy Efficiency

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ABSTRACT

The Smelter employs the Hall Héroult Electrolysis Process for the extraction of Aluminium from Alumina. Renukoot Smelter is one of the largest integrated primary producers of aluminum in Asia that encompasses the entire gamut of operations from bauxite mining, alumina refining, aluminum smelting to downstream rolling, extrusions and recycling, to continue our position as a leader in primary aluminum production in India. Over the years, we have improved the smelter performance in terms of energy efficiency and higher pot life, by successfully implementing some key changes in cathode lining. This low amperage plant also upgraded the smelting operations in a massive way by bringing innovative solutions, incorporating modernization programme like use of thermally balanced prebaked cathode blocks, leading to higher pot life and reduced energy consumption. Cathode blocks of various suppliers were used in some pots and performance were monitored. In view of increasing pot amperage and further reducing power consumption, thermo-mechanical modelling of Renukoot pots was done in which the pot design was changed with improved pot insulations and change in cathode blocks and collector bar design, thereby operating the pots with current density as high as possible. With all above initiatives, the pots are giving higher life and are also now comparable to modern high amperage pot lines in terms of energy efficiency. The objective of this paper is to discuss all the steps that have been taken at our smelter, especially in cathode design, for achieving the above mentioned results.

Key words: Bauxite Mining, Refining, Hall Héroult Electrolysis Process, Pot Amperage, Current Density, Energy Efficiency, Prebaked Cathode, Collector Bar and Thermo-Mechanical Modelling.

Benefits of Conversion from Amorphous to Graphitized Cathodes

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ABSTRACT

Cost efficiency, reduction of environmental impact and productivity increase are main drivers of development for the evolution of primary aluminum smelting technologies. Such continuous development requires changes in the materials used to build electrolytic cells, which must now follow stricter requirements. Modern cathodes must therefore have a different set of properties than those used previously. As a leading producer of carbon and graphite lining materials, COBEX has cathodes in its portfolio which meet the stringent requirements of modern smelting technologies. Carbon-based

cathodes (amorphous or graphitic), which were good for stable, low-amperage cells, start to fail with higher current densities and fluctuations in the power supply (e.g. power shortages). Graphitized cathode blocks can withstand such conditions and also bring important features of low electrical resistivity and high thermal conductivity which provides the basis for higher process efficiency.

This paper presents a comparison of carbon and graphite-based materials with an assessment of its impact on pot operation. The second part provides suggestions how to make the conversion to graphitized material and how COBEX can assist in this conversion. There is also a short description of COBEX's In-situ wear monitoring equipment – Lancelot™ – which has been developed for measurement of the cathode working surface and ledge monitoring during pot operation.

Keywords: Cathode, Graphitized cathode, Lining, Electrolysis, and Lancelot.

New Cathode Structure Technology for Restraining Horizontal Current

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ABSTRACT

Stability of large capacity cell is subjected to the horizontal current within cells. Therefore, how to securely and effectively restrain the horizontal current so as to achieve lower energy consumption and more stable production has becoming a vital factor affecting the designing of large capacity cell. This paper analyzes the causes why horizontal current can influence cell stability. With combination of Finite Element Method (FEM) and ANSYS workbench software, calculation module of reduction cell electric field has been established, based on which, comparisons are made between the two main horizontal current restraint methods--slotted collector bar and variable cross-section collector bar-- and advantages or flaws of each method are elaborated. Besides, effect in practical use is also discussed in this paper.

Keywords: Stability, Horizontal current, Electric field, Variable cross-section collector bar, simulation modeling and FEM.

Effect of Different Grooves of Hetero Type Cathode on Resistance Loss of Molten Aluminium

Wangruixue

ABSTRACT

In the special-shaped cathode aluminium reduction cell, in order to reduce the fluctuation of aluminium liquid, the upper surface of each cathode carbon block is not flat, but has convex protuberance. After laying such a cathode carbon block on the cell, a lot of "grooves" (or grooves) perpendicular to the longitudinal direction of the cell are formed on the bottom surface of the cathode of the cell chamber. This "groove" can cut off the flow of liquid aluminium in the groove and reduce the flow rate of cathode

liquid aluminium in the groove. In order to understand the influence of different sizes of "trenches" on the resistance loss of liquid aluminium after flowing through, a physical model was established and simulated by fluent. The results were obtained through post-processing, and the conclusions were drawn through comparative analysis.

Keywords: Special-Shaped Cathode Cell, Flow Field, Simulation Modeling, Finite Element Analysis.

The Discussion of Proportioning System in Green Anode Process

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ABSTRACT

This paper makes an analysis for different proportioning system in green anode process and provides the suggestion to select an appropriate proportioning system in a new project.

Keywords: Green Anode, Dry Material Proportioning System, Rhodax.

Use of Mathematical Modeling for the Aluminium Production of RUSAL Company

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ABSTRACT

The RUSAL Company is one of the major leading global aluminum manufactures. Ongoing analysis, progress, and development of new technologies allow RUSAL to maintain current position in hard rivalry conditions.

Maintenance and development of technical and technological OC RUSAL aspects are carried out by the special unit - RUSAL ETC (Engineering-technological center), that provide research and development of aluminum production technology, design of new reduction cells, cast technologies, and equipment, as well as their modernization.

Almost all of the technical solution researches go through mathematical modeling stage. Mathematical modeling allows to provide analysis with minimal costs and to estimate benefits from the suggested innovations, producing the optimal choice.

The present article contains the main activities of mathematical modeling department, including the temperature, electromagnetic, CFD and structural analysis, cast process simulations, etc., helping to improve existing technologies and product quality.

Keywords: Mathematic Modeling, Analysis, Simulations.

Discussion on the Measures of High Temperature Kneading and Low Temperature Forming by Intermittent Kneading Process

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ABSTRACT

This article describes the production status of intermittent kneading process of green anode manufacturing in prebaked anode plant and discusses the measures of high temperature and low temperature forming in intermittent kneading process by means of trial test, factory reforming and new process conception.

Keywords: Prebaked Anode, Green Anode Manufacturing, Paste Preparing, Kneading, Forming.

New Roof Ventilator Design for Potrooms and Baking Furnace Buildings

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ABSTRACT

It is a continues search to find the best design for roof ventilators for Potrooms.

The desire is to have a roof ventilator as light and as small as possible, but at the same time reliable, rainproof and strong against wind and last but not least, with the best performance for airflow capacity.

Widely used is the Colt Labyrinth, low profile, which offers a reduced height, less weight and proven structure to withstand all climate conditions.

Now we have taken the roof ventilator to a higher level where we have a combined roof/roof ventilator design resulting in a much simpler supporting structure for roof ventilators, less complicated erection of roof ventilators and at the end lower costs.

Keywords: No Leakages, Best Performance, Robust Structure, Easy Erection, Long Life Materials, Low Cost, Best in Class.

Study on Dual-Channel Electrolysis Flue Gas Purification Technology

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ABSTRACT

Dual-channel flue gas purification process and dust collector are a patented technology of GAMI. This technology can improve the efficiency of purification system with the sufficient adsorption performance of alumina. Meanwhile, the technology can reduce the amount of "crust" generated by the purification system and enhance the stability of the purification system. In addition, the purification process has the advantages of low CAPEX and OPEX. Combined with the practical application in an aluminum electrolysis project, the above-mentioned features of the technology and the actual effect of the purification system are illustrated.

Keywords: Electrolysis Flue Gas, Dual-Channel Purification Technology, Reactor, Crust.

Study on Thermal Equilibrium in Rotary Kiln during Calcination Process

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ABSTRACT

A large-scale prebaked anode plant in China was selected as the study site to mainly study the flue gas composition in the rotary kiln, and its thermal equilibrium was mainly analyzed and studied. The study has shown that SO2 and NOX in the flue gas emitted from rotary kiln exceed the standards seriously, especially SO2. Thus, it is imperative to purify the calcination flue gas emitted from rotary kiln. Further analysis of thermal equilibrium in the rotary kiln shows that its thermal efficiency is 9.46%, so how to optimize the rotary kiln requires the joint thinking and efforts of the designer and production personnel.

Keywords: Pet Coke, Rotary Kiln, Flue Gas Composition, Thermal Efficiency.

Some Problems and Improvement Measures of a Factory Affecting the Real Yield of Rotary Kiln

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ABSTRACT

In this paper, the production situation of petroleum Coke calcining rotary kiln in a domestic plant is

introduced, and the yield problem is analyzed, and some improvement schemes and measures are put forward.

Keywords: Calcination, Rotary Kiln, Real Yield, Improvement Measures.

Comprehensive Application of Supporting Facilities in Gas Treatment Centre

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ABSTRACT

The dry scrubbing system of alumina refining is widely used in aluminum smelter. The uniform and stable feeding of alumina powder and its full mixing with gas are fundamental to ensure the scrubbing efficiency. Meanwhile, the filter bag maintained in proper condition may guarantee the reduction of pollutant emission. In this paper, the key supporting facilities composing alumina material control and distributing system, reactors and broken bag monitoring system of scrubbing system are studied, and the results of comprehensive applications of the above in industrial practice are analyzed to achieve favoured results of pollutant reduction.

Keywords: Alumina Material Control and Distributing, Uniform Distributing, Reactor, Broken Bag Monitoring System.

Review and Prospect of Technology and Equipment Development of Metallurgical Carbon Industry in China

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ABSTRACT

This paper reviews the development history of metallurgical carbon materials technology and equipment in China, discusses the innovative characteristics of main technologies and equipment of metallurgical carbon in China, looks forward to the future development direction of metallurgical carbon technology, and puts forward the development ideas and suggestions of metallurgical carbon technology.

Keywords: Guiyang Aluminum Magnesium Design & Research Institute Cor. Ltd., Metallurgical Carbon, Steel Industry, Electrolytic Aluminum, Development Ideas.

Integrated Management of Waste Material in Carbon Products Manufacturing Plant

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ABSTRACT

This paper puts forward a novel conception to deal with three kinds of waste materials (pitch fume, carbon powder, waste tar) of carbon plant (including anode plant and cathode plant for aluminum smelter, graphite electrode plant), in which waste carbon powder generated by carbon production is used as the adsorbent for scrubbing pitch fume. Then the waste carbon powder and waste tar trapped by electrostatic precipitators are heated, kneaded, pressed and roasted into baked anodes of specified specifications, baked anode can be used as high quality fuel or used to make filling material for a baking furnace.

Keywords: Carbon Products Manufacturing Plan, Pitch Fume, Scrubbing, Waste Carbon Powder, Waste Tar, Integrated Management.

Research and Implementation of Carbon Block Intelligent Storage System Based on Websocket and HTML5

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ABSTRACT

The application of intelligent warehousing attracts more attention to the carbon industry. According to the actual production situation of carbon plants and the existing equipment level, it is divided into working procedures and operation flow of the warehouse and develops the intelligent storage system of carbon blocks to realize the intelligent scheduling of stacking cranes, perfect the inventory management of green blocks and anode baked blocks. Thus, the upgrading and transformation of the related functions such as accurate positioning can be reach an intelligent storage management for the carbon transfer station, and establish a complete set of carbon storage management system. This paper presents a systematic scheme based on WebSocket and HTML5, which is to solve the problems of crane dispatching, automatic storage of carbon blocks, real-time equipment data monitoring and suffice the needs of unmanned and intelligent development of enterprise production, and reduces the production costs and improve production efficiency.

Keywords: Intelligent Storage, Websocket Protocol, HTML5, Real-Time Communication.

Application and Practice of Data Warehouse in Aluminum Smelting Process

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ABSTRACT

In order to clarify some accurate data integration problems about aluminium smelting industry, based on the analysis of aluminium smelting, the emergence of Hadoop data warehouse solves the problems of data fusion, data mining and data sharing in aluminium smelting production process, which brings high efficiency to the benefit of production and application of analysis in aluminium smelting industry and greatly improves the production of enterprises. Benefits.

Keywords: Data Warehouse, Hadoop, Data Fusion, Aluminium Smelting.

Discussion on Building Ventilation Design of Guizhou Xingren Cell Shop

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ABSTRACT

It is not difficult to solve the problem of air intake in the cell shop. From the development of air intake design in the aluminium cell shop in the past decades, in the southern region, there have been several stages of vertical suspension window, ventilation hood and open rain shield at the tapping end (side) of the operation surface. At present, whether in terms of economic benefits or the effect of air intake, it is quite mature to use the open rain shield at the tapping end (side), and at the flue end (end) of this project, the louver which can automatically adjust the opening angle according to the wind direction is adopted. Compared to the air intake, the problem of air outlet in cell shop is more complex.

Keywords: Guizhou Xingren Cell Shop, Three-Dimensional Simulation Geometric Model of Natural Ventilation, Aluminium Alloy Arc Ventilator.

Discussion on Isolated Power Grid Operation in Aluminum Smelter

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ABSTRACT

By discussing the operation of isolated power grid in aluminum smelter, this paper briefly analyzed that the main stable control station should be set up under the condition of isolated power grid, and dual stable control sub-stations should be set up at the sides of power plant and aluminum smelter respectively. The control strategy of isolated power grid and the sequence of black start are put forward. The concepts of constant power control and the preferential protection of power grid after failure are emphasized, and the precautions under isolated power grid operation are pointed out. It is expected that this paper would be helpful to those aluminum smelters under isolated power grid operation.

Keywords: Aluminum Smelter, Isolated Power Grid, Frequency, Constant Power, Silicon Controlled.

Brief Analysis on the Design of SCR Rectifier Stability Control System under Isolated Network

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ABSTRACT

As a major power user, an aluminum smelter is with high power load grade, any power cut of a potline will bring great losses, even a black network, which will affect the stability of the whole system. When the power grid fails, the traditional stability strategies are low frequency, low cycle and load shedding, and the relay protection device directly cuts off failed units, which often fails to meet the requirements on stabilizing the power grid. In this paper, the problem of load matching between power generation side and the aluminum production side in a SCR rectifier aluminum smelter under isolated network condition is briefly analyzed. The new stability strategy is to use the rectifier unit PLC control system to adjust the DC load, so that when the source side fails, the system voltage and frequency fluctuations are controlled within the prescribed range, limiting the scope of the accident and reducing the accident losses.

Key words: SCR Rectifier, Isolated Network, Stability Strategy.

ALUMINIUM DOWNSTREAM

New melting and Casting Technology of Aluminum and Aluminum Alloys

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ABSTRACT

This paper introduces some new melting and casting technologies of aluminum and aluminum alloy in recent 5-10 years, and points out their basic working principles and advantages, then briefly introduces some technologies which are being developed and popularized. These technologies have great influence on the aluminum melting and casting industry, and they can provide reference for readers in the selection and renewal of melting and casting equipment.

Keywords: Alkali Removing Device, Low-Pressure Casting Technology of Billet, Rotary Degassing Device at Furnace Side Wall, Electromagnetic Stirring Casting Technology, Ultrasonic Liquid Level Measurement Technology.

Research on Structural Improvement of Open Ring Type Baking Furnace

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ABSTRACT

In view of the high energy consumption characteristics of open ring type baking furnace at present, this paper analyses the reasons from the design and proposes to reduce the energy consumption of baking furnace by improving the structure of furnace surface casting block, side insulation wall, connected flue and flue wall etc.

Keywords: Baking Furnace, Improvement, Structure, Energy Consumption.

Technologies for the Removal of Iron from Molten Aluminium

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ABSTRACT

Aluminium alloys are finding newer applications in automotive and aerospace industries. Primary aluminium metal is generally used for the high end applications requiring stringent quality requirements. The secondary aluminium route is expanding, due to its inherent advantages of lower

energy consumption and lower carbon footprint. Using recycled aluminium to produce aluminium alloys causes an increase in the level of other elements (impurities). Iron is considered as the most crucial impurity element in aluminium alloys. They form brittle intermetallics that seriously degrade the mechanical properties of aluminium alloys. In this paper, current available technologies are reviewed that could be put to use to achieve superior quality of secondary aluminium, with the impurity levels such as iron within the specified limits. The aluminium industry desires a process that can take scrap from various sources and produce high quality products. A combination of electromagnetic refining and the filtration process holds a huge potential in providing a flexible, and environmental friendly technological solution to the secondary aluminium industry.

Keywords: Iron intermetallics, Aluminium, Refining.

Quality of AA6063 Alloy Billets

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ABSTRACT

AA6063 alloy is one of the most common alloys in the AA6XXX series which is used in extrusion due to its high extrudability, good surface finish, corrosion resistance and excellent response to anodizing. AA6063 alloy is typically used in pipe, railings, furniture, architectural extensions, truck and trailer flooring, doors, windows, pipes, etc. The overall extrusion process for AA6063 alloy consists of melting, alloying and casting of billet, homogenization, preheating to working temperature, extrusion, stretching, solution treatment and ageing. Extrusion formability and properties depend on the chemical composition and degree of homogeneity of the billets. The quality of any extruded product is defined by various parameters, such as chemical composition, geometrical dimensions, microstructure, and variation of mechanical properties over the extruded length and cross section, and surface finish. An extruded profile may be rejected if it fails to attain adequate mechanical properties, exhibits poor surface finish, inclusions in the extruded sections and unacceptable response to anodising operations. Such failure may occur owing to any of the following reasons such as defective billets, faulty or unsuitable tooling, defects arising during extrusion and flaws resulting during post-extrusion operations.

Certain aspects of billet quality are different between the billet caster and the extruder. From the caster point of view billet shall have smooth surfaces, no oxide releases, no surface lapping, no surface drags, no horizontal tears, and no surface or radial cracks and internally thin shell thickness, small-uniform grains, small dendrite arm spacing, no internal cracks, no inclusions, and good homogenization. From the extruders point of view, essential quality parameters are correct and consistent alloy chemistry, thin shell zone, no inclusions, no external defects or internal cracks and good homogenization.

The extrusion industry, in general, is focusing on increased productivity, improved consistency with respect to press performance and functional properties of the product. Billet defects lead to production losses, either reflecting the cost of rework or of scrap. Furthermore, customers of extruded products have become more demanding, forcing their suppliers to look for improvements of the production

process and consequently on their main raw material: the aluminium billet. Present paper describes quality traits of AA6063 billets that are metallurgically and economically suitable for the extruder.

Keywords: AA6063, AA6XXX, Extrusion, Homogenization, Alloy chemistry, Shell zone.

Innovative Product Design and Robust Process Layout in Die Casting with Autonomous Engineering

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ABSTRACT

Innovative automotive lightweight designs lead to a higher demand for the product and process development of die cast components. This is attributed to shorter and shorter product development cycles as well as the rising functional integration and complexity of structural die cast parts. The main objectives of the technically complex processes and tools in aluminum and magnesium die casting are cost and resource efficiency along with the robust fulfillment of the defined high-class requirements of the casting. In this context, casting process simulation is a well-established tool used to support tool design, part design as well as process development.

Using the example of a structural die cast part this paper demonstrates how the new methodology of Autonomous Engineering of MAMASOFT® 5.4 contributes to the demands of die casting for:

- Faster product and process development,
- Optimum process and tool design in terms of quality, yield and costs, as well as
- Robust process layout with maximum reproducibility of quality better than ever before.

Autonomous Engineering expands on the virtual experiment of casting simulation by defining the quantifiable objectives, critical variable process parameters and their variations as well as relevant quality criteria. In addition to the identification of reliable technical solutions, this new approach provides the best compromise between the quality and economic efficiencies the die caster is always striving for.

Systematic knowledge can be generated without economic or production risks enabling secured decisions to be made early in the development phase of robust, cost-efficient and resource-efficient die cast products and processes.

Keywords: Die Cast Components, Part Design and Development, Cost and Resource Efficiency.

Production Process and Development Trend of Short Process for Aluminum Strip

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ABSTRACT

Comparison of three production processes: cast-rolling, ingot hot-rolling, continuous casting and rolling. Among them, continuous casting and rolling is a short process. Hazelett process and Micromill process are introduced in detail. Points out that, after solving the problem of surface quality and production process, continuous casting and rolling process will be one of the developments of aluminum processing.

Keywords: Short Process, Continuous Casting and Rolling, Hazelett, Micromil.

Die Design and Press Validation for a Complex Profile Produced by Port Hole Dies Using AA6063 Alloy

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ABSTRACT

In aluminium extrusion process, bulk deformation of work-piece is inevitable due to application of high magnitudes of compressive forces. The individual and interactive effects of friction, deformation/strain imparted, strain rate, temperature, etc. determine the mechanical and structural properties of profile. Design of dies and tooling is a critical step in aluminium extrusions and the practice of determining design variables of die are based on knowledge of metal flow by trial and error methods. The design process can be simplified with the use of process models approach by extensive numerical simulations followed by press trials.

In this technical communication, a complex profile was taken up for studies from aluminium extrusion industry and validated on a 1600 Ton extrusion press using AA6063 alloy. In the conventional porthole die design, the industry has used four port design and subsequently faced challenge of profile bending due to non-uniform metal flow and was unacceptable. In order to achieve uniform metal flow, systematic die design modifications through simulation studies were carried out and arrived at modifications in port holes from four to six, a pocket and bearing modifications were implemented in the final design. Die was fabricated and in order to carry out design validation, a press trial was conducted. The extruded profile with the modified die design indicated straightness i.e., without any bending or twisting and the profile could be extruded successfully in first trial itself. This indicates the validity of the design modifications taken up and the overcome the problem faced by industry. Also, the product exit temperature obtained through simulation (551°C) is in good agreement with the temperature measured at press trials (532°C).

Keywords: Aluminium Extrusions, Port Hole Die Design, Design Validation.

Various Grades of Wire-Rod Development

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ABSTRACT

BALCO, with a market share of 35% in aluminium wire rod industry across India, is the first integrated aluminium industry in India and is the first to launch alloy rods for conductors used in power transmission industry.

The main aim of this paper is to explain over the journey of BALCO (from 1965 till date) as a leading manufacturer of aluminium products in India. Initially, the production facility at BALCO produced 2 grades of wire rods. Through process reengineering and parameter re-estimation, 11 grades of wire rods are produced now to cater to the technical specification demanded by the customer. In-house designing of the following - roll profile, roll diameter, gear teeth, gear diameter, shaft assembly, entry guide, and exit guide were done and mill programmes were setup for different grades of wire rod production. Varied grades of wire rods produced at BALCO are EC high UTS, EC low UTS, 7.65 mm rod, and alloy rods O&M temper as (cable and conductors). New products, such as high strength rods (12 mm & 13 mm diameter), and flipped coils (12, 13 mm), T4 and AL59 alloy rod are also produced.

BALCO supplies wire rod to 235 customers in India with 2.50 lakhs tonnes capacity wire rod per annum. A global substitution away from copper to lower priced aluminium is under way for the electrical equipment industry. Over the last decade, the price differential between copper and aluminium has surged by more than fivefold sparking a new movement towards aluminium as the electricity-conducting metal of choice among leading manufacturers.

Keywords: BALCO, Aluminium Wire Rods, Alloy Rods for Conductors, New Products, and Modification.

Productivity and Quality Improvement in EC-grade Wire Rods

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ABSTRACT

The major consumer for aluminum in India is the electrical sector. These conductors are manufactured mainly by continuous casting through Properzi wire rod mill. The present study was focused on the process optimization work done on a newly commissioned Properzi wire rod mill to resolve the quality issues like with-in coil UTS variation and cast bar cracking instances with increasing casting speed. The current talk will focus on the methodology adopted to address the three major aspects viz. process inputs, metallurgical aspects and process optimization aspects for resolving the aforementioned quality

issues. To address the input aspects, sources of variations in the input side were identified and necessary process modification were implemented at plant. To understand the effect of metallurgical parameters like precipitate type, size & morphology etc. on the variations, the cast bar and wire rod sample were characterized for different grades. However, the results depicted that these were not the major cause for the quality issues. A detailed statistical analysis was conducted which led to the identification of unstable air-gap formation between cast bar and mold surface during solidification as the root cause for all the above variations. This instability caused a sudden change in heat extraction during cast bar solidification resulting in cast-bar temperature variation, and ultimately led to UTS variation of the wire rod and thermal cracks in the cast bar. The cooling pattern optimization was successfully conducted at plant with systematic DOE approach and the optimal recipe at an increased casting speed were developed. The implementation resulted in reduction of UTS variation to approximately half, while cast bar crack instances were limited to assignable causes only.

Keywords: Conductor, EC-grade wire rod, AA1350 alloy, UTS variation, Thermal cracks, DOE.

Selection of Production Process Scheme for Aluminum Alloy Petroleum Drilling Pipe

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ABSTRACT

With the decrease of oil and gas resources, its exploration and drilling have gradually turned to deep wells and ultra-deep wells, deep-sea, complex geological and geographical conditions, and many unfavorable factors have been exposed in traditional steel drilling pipe fittings. Compared with traditional steel pipe, aluminum alloy pipe has obvious advantages of light weight, high specific strength, high plasticity and strong corrosion resistance, and is suitable for directional and horizontal wells with large area ratio, and can significantly improve drilling capacity. However, hot extrusion technology is the core and key of the production process of aluminum alloy oil drilling pipe. The selection of production process and determination of the main parameters of extruder are the important contents of pre-research of aluminum drilling pipe projects. In this paper, the oil drilling pipe with brand 2112 T6, outer diameter 147 mm and inner thickness 11 mm (t1=34) is taken as an example, process selection analysis is made, and the optimum tonnage of extruder, the specifications of extrusion cylinder and perforating needle, and the force on perforating needle are calculated and determined, which provide the basis for determining the pullback force of perforating needle of extruder. The calculation shows that the 60 mm double-acting reverse extruder is suitable for the production of the drilling pipe, 420 mm diameter extrusion cylinder and 125 mm diameter perforating needle are the best choice, and the pullback force of the perforating needle of the extruder should not be less than 10.52 mm.

Keywords: Petroleum Drilling Pipe, Variable Section Pipe, Petroleum Industry, Force on Perforating Needle.

Discussion on the Design of Aluminum Alloy Pedestrian Overcrossing

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ABSTRACT

This paper introduces the development and design characteristics of aluminum alloy pedestrian overcrossing. Because of many advantages of aluminum alloy structure, aluminum alloy pedestrian overcrossing is more and more used in municipal engineering. However, due to the lack of in-depth research work and the lack of connection mode, its development process is limited to some extent. Based on the characteristics and existing problems of aluminum alloy pedestrian overcrossing, this paper discusses the reasonable design method.

Keywords: Pedestrian Overcrossing, Aluminum Alloy, Truss Structure, and Optimization Design.

Development and Application of Automatic Packing System for Aluminum Ingots

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ABSTRACT

This paper is regarding the development and application of automatic packing system for aluminum ingots. At present, most of the packing processes for aluminum ingots at home and abroad are manual packing, which has some shortcomings, such as low work efficiency and great potential safety hazards. Combining with the production and management concept of cost reduction and efficiency enhancement, it is a general trend to develop the automatic packing system for aluminum ingots, which also reflects the future of intelligent production process.

The automatic ingot packing system is composed of three parts: transfer mechanism, packing mechanism and electric control system. After packing, each stack of aluminum ingots weighs 1 tonne, and is stored in the designated area. The aluminum ingots are transferred to the waiting area by the transfer mechanism. The number of aluminum ingots is determined by the volume of each container, and the aluminum ingots are transported by the packing mechanism to the designated positions inside the container, stacked from inside to outside, until the container becomes full. This system is with centralized control and simple process flow, which can meet the actual production needs, and is highly worthy to be popularized.

This system is with simple process flow, convenient operation, safe & reliable, high packing efficiency and centralized control, with which the goals of intelligent production, cost reduction and efficiency enhancement can be achieved.

Keywords: Aluminum Ingot, Automatic Packing System, Container, Intelligent, Cost Reduction and Efficiency Enhancement.

Development of Crane for Graphite Furnace Cover

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ABSTRACT

Graphitization furnace cover is a necessary equipment for collecting flue gas in the process of graphitization. The normal crane is used to hoist and install the cover in conventional graphitization workshop, which occupies a lot of manpower and has potential safety hazards. A special crane for automatic lifting and installation of graphitization furnace cover is presented in this paper. The crane can be operated remotely through the control system. At the same time, the reliability and feasibility of steel structure of large graphitization furnace cover during integral lifting are verified by finite element simulation. The development of the crane is of great significance to the construction of automated and intelligent graphitization workshop.

Keywords: Graphitization Furnace, Cover, Crane, Automation.

GENERAL

The Analysis of China's Aluminum Market

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ABSTRACT

Since 2017, China started the reform on supply side of electrolytic aluminum, and with the policy landing in 2018, around 5 million tons of illegal capacity was shut down, which was the significant turning point of China's Aluminum industry development. In 2017, the growth rate of China's Aluminum capacity slowed down remarkably. And in 2018 the capacity slowed down slightly compared with the same period of the previous year, which is the first decline in China's aluminum since the statistics are available, influenced by which, the electrolytic aluminum price raised remarkably compared with the previous two years in 2017-2018, and the profitability of enterprises is also getting improved. The capacity replacement policy of electrolytic aluminum is an important policy to maintain the achievements of supply-side reform. The new smelter project can be constructed only based on replacement of compliant eliminated capacity, which has been an important policy basis for managing the growth of capacity of electrolytic aluminum in China, and no enterprise can ignore this policy.

Over the past two years, China's environmental protection policy has been extremely strict. Besides the policy of restricting production in the heating season, strict restrictions have been imposed on the compliance of mining operations, the illegal mining enterprises were forced to shut down, and the approval for the new mining certificates was at a standstill, which has led to a decline in the supply of bauxite in China from 2017 to 2018. At the same time, the new capacity of alumina in Shanxi has been put into operation, which cause the contradiction between bauxite supply and demand, bauxite prices soaring sharply and high production cost of alumina refineries. Especially in Shanxi and Henan, the production cost of alumina refineries reaches 2800-3000 yuan/ton. However, alumina price is difficult to maintain above this cost line for a long time. Since the end of 2018, alumina price has fallen back. Most alumina enterprises in both places are in loss. In the first quarter of 2019, alumina production in China has declined by 5 million tons accumulatively.

China's inland alumina enterprises like in Shanxi and Henan have faced the situation of high domestic bauxite prices for a long time, which has forced local alumina enterprises to try overseas ores. However, due to the large grade variation, the enterprises cannot use imported ores in large quantities. Most enterprises can only mix a small amount of them. Only a few enterprises decided to change the original production line, i.e. changing the high temperature line to low temperature line, so as to use imported bauxite completely. In the next few years, the proposed alumina projects in China will focus on the use of overseas ores. However, due to the large-scale concentration and suspicion of pollution of the proposed alumina capacity in Liaoning Province in 2018, the local residents protested, so the local government called off all proposed projects. At the end of 2018, China issued the first regulatory policy for the orderly development of alumina, which predicted that the expansion of alumina production capacity in China will be limited in the future. It is expected that the scale of using overseas ore in the next two years will not be massive.

We believe that China's aluminum industry will embark on a benign development path with the opportunity of supply-side reform of electrolytic aluminum and the guarantee of capacity replacement policy.

Keywords: Aluminium Development, Environment Protection, Alumina Enterprises, High Domestic Price.

The Application and Discussion About the Aerosol Automatic Fire Extinguishing System Used in Industrial Substation

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ABSTRACT

The transformer room is the core part which maintains the normal operation of daily production and life in the building. Once a fire occurs and it cannot be extinguished in time, it will cause heavy losses and even casualties. Therefore, it is of great significance to set up automatic fire extinguishing device in the transformer room. This paper mainly analyzes characteristics of a fire in the transformer room. Combined with the practical engineering and the principle and characteristics of the aerosol fire extinguisher, this paper puts forward the advantages of the device in the transformer room and puts forward the improvement methods.

Keywords: Automatic Fire Extinguishing System, Aerosol, Fire Detector, Micro Automatic Fire Extinguishing Device.

Study on Internal Flow Field of High Efficiency Desulfurization Tower

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ABSTRACT

With breakthrough of environmental protection technology, the research of high efficiency desulfurization tower has been paid more attention in recent years to meet the rising environmental regulation. Desulfurization efficiency is obviously affected by the distribution of flue gas field. The more uniform the flow field is, the better the desulfurization efficiency is.

In this paper, the flue gas distribution in desulfurization tower is numerically simulated by using ANSYS Fluent. Under the six conditions of tray aperture ratio of 1.0, 1.05, 1.11, 0.95, 0.9 and 0.8, the effects of uniform aperture distribution and different aperture distribution on the flow field uniformity in the desulfurization tower were obtained. It is indicated that the flow field uniformity is better when the aperture at the opposite side of the flue gas entrance is larger than that of the entrance side. The flow field uniformity gets the best when aperture ratio is between 0.9 and 0.95. Moreover, the inclination angle of flue entrance also affects the uniformity of flow field. The simulation results can be seen when the entrance angle is 11^0, the flow field uniformity is best.

Keyword: Desulfurization Tower, Fluent, Tray, Numerical Simulation.

Discussion on the Application of Atmospheric Prediction Software Eiaproa 2018 in Eia

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ABSTRACT

EIAProA 2018 as the atmospheric EIA professional assistant system referred to as, the software in the 2018 edition of China atmospheric environment impact assessment guide based on the preparation by AERSCREEN/AERMOD/SLAB/AFTOX kernel model. This thesis with a chemical company as an example introduced EIAProA 2018 software application, by predicting the ground concentration of pollution factors in accident and normal operating conditions, the ambient air protection goals, mesh point of, evaluation range maximum hourly ground concentration points to analysis effect of the Electrolytic Aluminum enterprises discharge of atmospheric pollutants on the surrounding environment and sensitive point.

Keywords: Atmospheric Prediction, Eiaproa 2018, Predicted Concentration Influence.

Research on Configuration Mode of 220 kV Integrated Automation System in Aluminum Smelter Projects

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ABSTRACT

With an example of a 500 kt/a aluminum project in Denggao, Xingren, Guizhou Province, a new mode of on-site configuration for 220 kV switchyard integrated automation system is introduced in details in this paper.

This new mode has broken the traditional mode by which the protection and monitoring equipment for all the equipment in 220 kV switchyard are located in the main control building, creatively located most of the bay level protection, monitoring & control equipment outdoor in the corresponding bays in switchyard, realized the modular design of integrated automation system, and improved the reliability of system power supply.

Keywords: Aluminum Smelter, 220 kV Switchyard, Integrated Automation System, Bay Level, Modular Design, on-site Configuration.

Supporting Low-Carbon Infrastructure: Consolidation of Industrial Rejects by Geopolymerization and Immobilization of Toxic Components for Utilization

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ABSTRACT

The potential of alkali activated alumino-silicate minerals known as geopolymers in the formation of a new class of construction materials has been in development. Geopolymers are environment friendly substitutes for Ordinary Portland cement (OPC) to reduce greenhouse gas emissions and also to consume large volumes of industrial rejects such as fly ash, mine tailings and variety of metallurgical slag for making structural units. In recent past, geopolymerization has emerged as a reliable technological solution for stabilization and immobilization of toxic components including heavy metals in industry rejects and byproducts.

This paper provides some important aspects of geopolymer materials derived from synergistic use of rejects from industries as well as biomass origin. The effective management of material compatibility based on composition and mineralogy, impact of alkali activator on crushing strength, variation of curing time, and measures for efflorescence control are discussed in terms of selective mix designs. Products of hard, light weight and sandwich type comprising single and multi-component mix design are used for developing products for flooring, wall construction, decoration, etc. Material sustainability indicator (MSI) in terms of embodied energy and CO_2 emission showed increasing trend with increase in concentration of alkali activator. This indicates that geopolymer made from the combination of industry rejects is a cleaner source of low-carbon infrastructure generation.

The scope of utilizing geopolymerization for toxic immobilization of heavy metal in hazardous waste and product development also conferred with paradigm that elaborate the efficiency of geopolymerization for detoxification of lead smelting slag.

Keywords: Industrial Rejects, Geopolymerization, Low-Carbon Infrastructure, Toxic Immobilization, Product Development.

Feasibility Study and Analysis on Desulfurized Gypsum used as Ash Yard Dam Foundation Material

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ABSTRACT

Taking the ash yard of Xingyi Power Plant using gypsum as dam foundation material as an example, under the experimental conditions of a large number of desulfurization gypsum related properties, through the analysis on the overall stability of gypsum as dam foundation material, this article concludes that gypsum as dam foundation material in the ash yard is feasible, thus alleviating the safety and environmental risks of the ash yard, which puts forward a new idea for ash storage yard for the enterprise, saves greatly the cost of dam foundation materials, and at the same time, increases the volume of gypsum deposited in the ash yard and extends the service life.

Keywords: Desulfurized Gypsum, Ash Yard, Water Content, Compactness, Stability.

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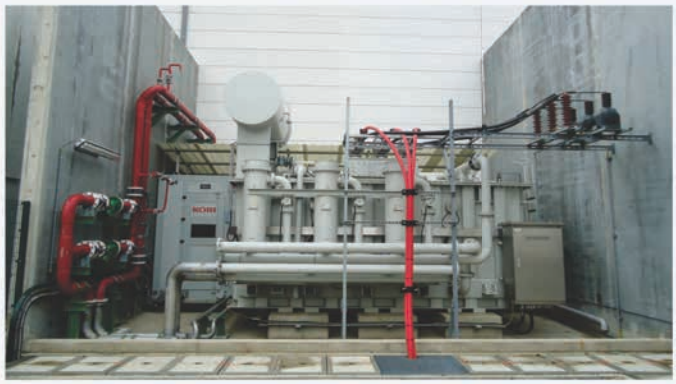

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山东鲁阳节能材料股份有限公司

山东鲁阳节能材料股份有限公司始建于1984年，2006年在深圳证券交易所上市，2015年与耐火纤维材料专业生产商-美国UNIFRAX（奇耐联合纤维公司）战略合作，历经30余年的发展，已成为集陶瓷纤维、玄武岩纤维、氧化铝纤维、硅酸镁纤维、可溶纤维、轻质耐火砖等新型节能材料研发、制造、销售于一体的中外合资企业，是专业的无机纤维材料生产商，国际标准、国家标准和行业标准起草单位，国家火炬计划重点高新技术企业、国家新材料产业化骨干企业、全国守合同重信用企业。

公司设有国家认定企业技术中心、国家级实验室、博士后科研工作站、山东省陶瓷纤维工程技术研究中心，拥有124项专利、54项技术成果，是国家863计划的协作单位。依托美国UNIFRAX世界最先进的知识产权、独有专利、专有技术等优势，两家强强联合，在关键设备升级、先进技术引入等方面，充分发挥其资源优势，公司专门设计了铝行业专用系列产品，为铝行业提供更加优异的保温隔热解决方案。

“鲁阳”已成为全球环保节能领域具有核心竞争优势的品牌。


碳素行业-威盾涂层组件系统

一种全纤维，轻型化结构系统，该系统采用美国奇耐UNIFRAX 专有技术生产，旨在解决传统耐火砖、浇注料结构存在的施工难、散热损失严重、蓄热大、温度升降慢、能源浪费等问题。

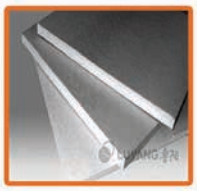
使用范围：连通火道、煅烧炉高温、低温烟道、焦炉集气管、集合管、炉门等高低温耐侵蚀衬里。



铝电解槽纳米板

铝电解槽纳米板， 是一种纳米级微孔隔热材料， 是迄今为止隔热性能最好的高温固体隔热材料。产品在低温下，具有比静止空气还低的导热系数， 其导热系数随温度升高少量增加， 高温下保温效果是传统保温材料的 3~4 倍。

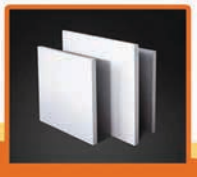
该产品应用于电解槽的背衬层，可有效降低外壁温度，降低散热损失，是实现节能降耗的理想材料。



铝电解槽高强绝热板

铝电解槽高强绝热板，是采用引进的美国UNIFRAX专有技术，以新型耐高温、纯无机纤维材料为骨料制成的高强度、低导热、不与电解质反应、抗侵蚀、节能效果显著的铝电解槽背衬专用全新板材。

产品解决了传统硬质材料与电解质起反应、烧蚀，造成电解槽漏液等问题，是铝电解槽背衬隔热、防渗抗蚀的最佳选择。



氧化铝行业-硅酸镁纤维毯

产品以可溶纤维为原料，采用公司“可溶、憎水”专有技术生产，具有极佳的耐热性能、憎水性能和安全优势,是公司专用于氧化铝行业罐体、管道保温的高档节能产品。

该产品是公司专利产品，已获得两项国家发明专利授权，授权号分别为ZL200910231320.7、ZL200310105697.0。



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株洲天桥起重机股份有限公司

ZHUZHOU TIANQIAO CRANE CO.,LTD.

株洲天桥起重机股份有限公司（股票代码:002523）成立于1999年，致力于为广大客户提供高端装备智能系统的解决方案,是我国南方地区最大的桥、门式起重设备制造商，是国内两家最主要的电解铝、电解铜、电解铅、锌电积专用起重设备制造商之一。业务范围涵盖物料搬运装备、有色冶炼智能装备、港口码头装卸船机、选煤机械、高端立体停车装备、风能发电、真空造雪装备等。其中铝电解多功能机组、桥门式起重机、大极板全功能自动剥锌刷洗机组、装船机械等产品广泛应用在国内各大铝厂、钢厂、港口码头并出口至意大利、印尼、德国、阿曼、俄罗斯、越南、赞比亚、委瑞内拉等。

Zhuzhou TianQiao Crane Co., Ltd.(Stock Code：002523), founded in 1999, is committed to providing high-end equipment intelligent system solutions for customers. It is one of the largest bridge and gantry crane equipment manufacturer in southern China. It is one of the two major manufacturers of special lifting equipment for electrolytic aluminium, electrolytic copper, electrolytic lead and zinc electrowinning in China. The business scope covers material handling equipment, non-ferrous smelting intelligent equipment, port terminal loader and unloader, coal preparation machinery, high-end stereo parking equipment, wind power generation, and vacuum snowmaking equipment. Among them, pot-tapping machine, bridge & gantry crane, large-plate full-function automatic zinc stripping and brushing unit, loading machinery and other products are widely used in domestic aluminum factories, steel mills, port terminals and exported to Italy, Indonesia, Germany. , Oman, Russia, Vietnam, Zambia, Venezueltea, etc.

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华冶电气
CHINA METALLURGICAL ELETARIC

阴极钢棒全截面焊接机

Cathode steel bar welding machine

本公司自主研发的阴极钢棒焊接机拥有多项发明专利，填补了国内电解铝行业强磁场环境下阴极钢棒全截面焊接的空白，该设备采用窄缝电熔焊工艺，从阴极钢棒的下方开始焊接，使用阴极钢棒焊接机焊接的阴极钢棒，焊缝区与阴极钢棒熔为一体，压降值远低于传统钢连片焊接。目前在新疆、内蒙、山东、陕西、广西、贵州等地区有多家铝厂使用。

焊接后的钢棒切片

阴极钢棒焊接效果

采用阴极钢棒焊接机焊接的阴极钢棒压降值远低于传统钢连片焊接

优点

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- 自动化程度高
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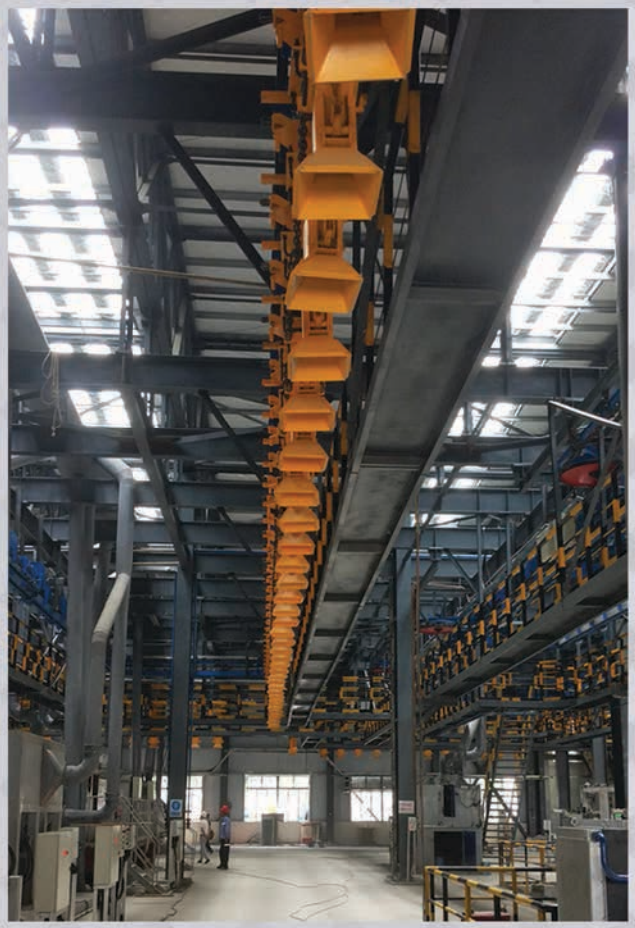
承德高线输送设备有限公司

CHENGDE GAOXIAN CONVERYOR MACHINERY CO., LTD.

是专业生产冶金行业输送机的厂家。截止目前为止，生产冶金业输送线主机和零部件业务占公司业务总额的70%，我公司2016年全年完成销售额2.08亿元人民币。

企业不断加强设备实力，细化制造工艺，完善检验手段，提高产品质量，曾先后建立了材料理化试验室和外协产品检验中心，具备了外协产品及原材料进厂的全面检验能力。根据国外技术的特点，结合企业产品性质，建立了标准工装开发和组合夹具制作系统，切实使产品质量得到提高。

ISO9001系列标准的执行，使得承德高线已经具备了国际通用质量保证体系，将企业的运行纳入了正规化、法制化的轨道。



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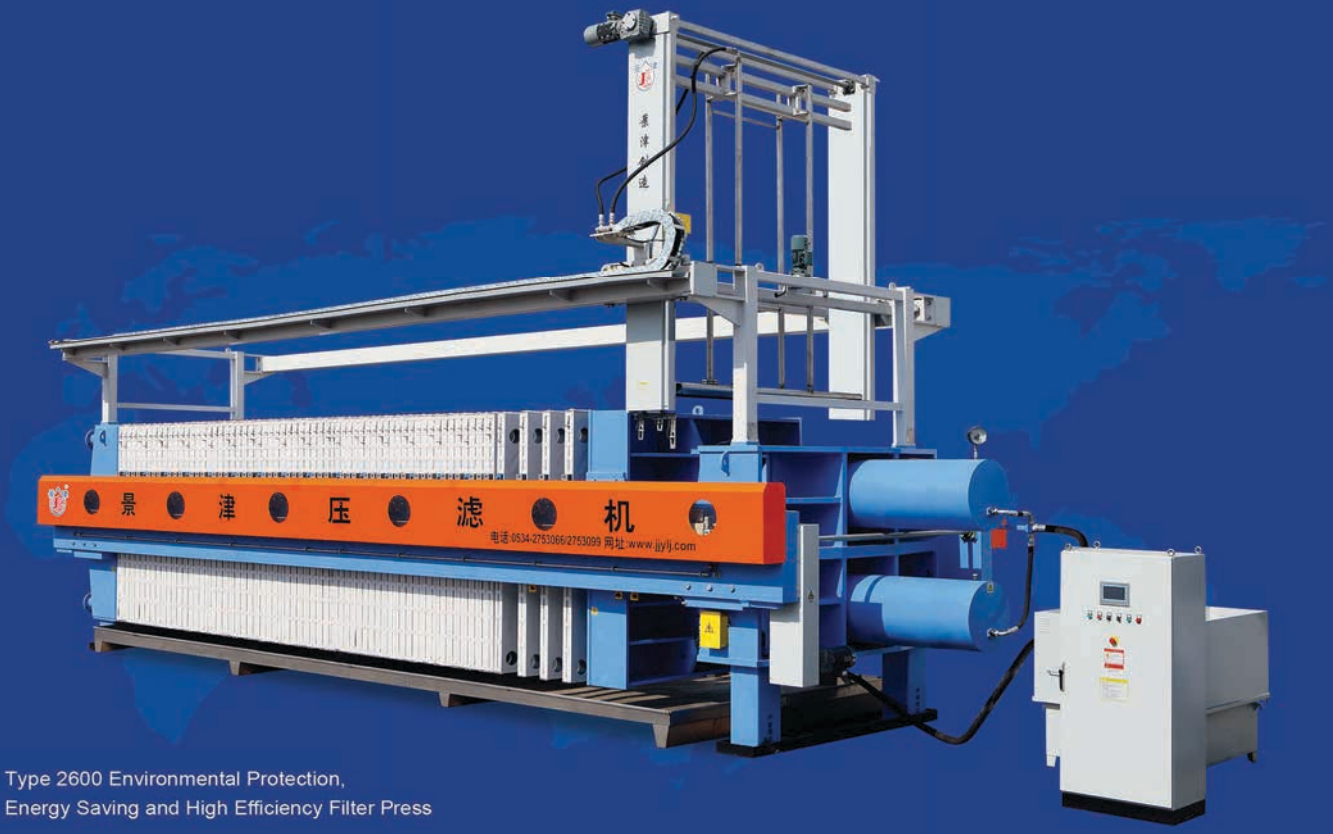

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