INTERNATIONAL COMMITTEE FOR STUDY OF BAUXITE, ALUMINA AND ALUMINIUM

ICSOBA

NEWSLETTER

A biannual publication

Volume 10 – December 2013

CONTENTS

The picture on the front page shows the participants in the ICSOBA-2013 Conference in Krasnoyarsk.

In case you consider publishing in this forum, please contact the editor before writing your article.

Deadlines for a June issue is 10th of June and for a December issue 10th of December.

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ICSOBA is registered as non-profit association at:
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Corporations Canada, Ontario under number 802906-7, and
Registraire des entreprises, Quebec under number 1167982181.

FOREWORD

Dear ICSOBA Members!

As we hit the end of December and the ground and trees here in Canada are starting to be covered with snow, you have probably heard "It's time to reflect" a thousand times. Not that reflection has really stopped during the summer or fall; "reflection" also means “to review and to make resolutions." Clearly, this year has provided us with plenty of opportunity to reflect as our organization reached the 50-year mark. A lot has happened in those 50 years. Like any organization ICSOBA too has passed through its ups and downs but every year made it stronger. The most important thing is that ICSOBA can be proud of its past and we its members can look with optimism into the future. Now, just look at the numbers. In the last 50 years, the ICSOBA committee has organized 31 (thirty-one) conferences in fifteen (15) countries, on four different continents. Thousands of participants contributed to the ICSOBA events from all parts of the world. The depth of the ICSOBA heritage can be measured by the TRAVAUX volumes that have been electronically scanned and are now available to all members. This precious heritage sets ICSOBA apart from other organizations of a similar vocation and provides us with a unique identity.

For the 50th ICSOBA anniversary we decided to join forces with the «Non-Ferrous Metals of Siberia" (NFM) and offered our members something they have never experienced. Russia and particularly Siberia are rich in scientific and practical knowledge in the aluminum industry. So for ICSOBA it was important to celebrate its fiftieth anniversary with the NFM Congress and all of its guests and delegates in Krasnoyarsk. I think we had a great and distinctive event that was mutually beneficial to both international and Russian delegates. The NFM provided an excellent support and organization quality that largely contributed to the ICSOBA 50’s anniversary celebrations and to the success of the conference. This year’s conference was unparalleled in its ability to attract more than 700 participants jointly with NFM and 160 speakers for ICSOBA alone. The organizers and participants of the Krasnoyarsk conference would like to express their thanks and gratitude to all the sponsors, co-sponsors, supporters, advertisers, invitees, Council members and individuals involved with the arrangement of this event for their steady and relentless support. Our appreciation goes to all of you who attended the 2013 ICSOBA & NFM conference this past September.

Our next meeting will be in Zhengzhou, China in October 2014 and you are all cordially invited to participate. The Call for Papers with all preliminary pieces of information has already been distributed. Please start your preparations for joining us in China next year. China will mark beginning of the second half century for ICSOBA. There is no doubt that the period of time to come will be rich in accomplishments and equally rewarding for our organization. For now I invite you to reflect and enjoy the very special spirit that the Holiday Season and the New Year celebrations bring upon us.

Best regards,
Frank Feret
President of ICSOBA
Saint Colomban, Québec, Canada

NEWS AND EVENTS

A Summary on the ICSOBA-2013 Conference, in Krasnoyarsk, Russia

For its 2013 annual event, the International Committee for Study of Bauxite, Alumina and Aluminium (ICSOBA) has teamed up with Non-Ferrous Metals Siberia (NFM). During the joint International Conference & Exhibition that was held from 3 to 6 September in Krasnoyarsk, Russia, ICSOBA also commemorated its 50th anniversary. All ICSOBA members received a 50 years jubilee pin and past-presidents were awarded with a historic medal.

Since the association's foundation in 1963 it is ICSOBA's mission to unite industry professionals representing bauxite, alumina and aluminium producing companies, technology suppliers, researchers and consultants from around the world and facilitate the exchange of knowledge, know-how and results of research. This is achieved by organizing conferences with a rotating the venue enabling both international industry members to visit areas of interest and professionals from possibly remote areas to participate in an international event. As such ICSOBA's 2012 conference was held in Belém, Brazil and the 2014 conference will be held in Zhengzhou, China.

Including those who came for rare and precious metals, the total number of registered participants in the Krasnoyarsk Conference was 571 from 243 companies. The joint ICSOBA-Aluminium of Siberia sessions were attended by over 300 delegates from 30 countries: 125 international delegates that registered through ICSOBA, 156 delegates from UC Rusal, and a not exactly known number of other Russian and non-Russian delegates that registered through NFM.

The importance of aluminium in the non-ferrous conference & exhibition is reflected in UC Rusal's support as sponsor and co-organizer. In particular Dr Andrey Panov - Director Alumina of UC Rusal's Engineering and Technological Center as well as ICSOBA vice-president and Dr Viktor Buzunov, Director Aluminium of UC Rusal's Engineering and Technological Center as well as ICSOBA Council Member, played key roles as organizers. Other sponsors of this event included Outotec, Bilfinger water technologies, Weir-GEHO, Shandong Jingjin Filter press, FLSmidth, Cytec, Nalco, R&D Carbon, Siberian Federal University, National Mineral Resource University and Institute of Chemistry and Chemical Technology.

For September 3rd delegates could join either a full day technical excursion to Rusal's Achinsk refinery where nepheline ore is used as raw material instead of bauxite or to Rusal's newest Khakas smelter, or participate in a workshop with lectures of:

- Dr. Rene von Kaenel, KANNAK, Switzerland: Modeling in metallurgy and approach to calculating fields and fluxes
- Prof. Barry Welch, New Zealand: Constraints and options for reducing energy consumption in aluminium smelting
- Prof. Peter Polyakov, SFU, Russia: Aluminium reduction technology
- Dr. Frank Feret, ICSOBA, Canada: Characterisation of carbon materials for the electrolysis process control
- Prof. Halvor Kvande, Norway: Electrolytes of the modern design and Söderberg cells and methods of their control
- Dr. Jeffrey Best, Hydro, Canada: An introduction to lateritic bauxite – from exploration through exploitation
- Leslie Leibenguth, LWL Technical Services, USA: Development, current status and the challenges of alumina production.

The joint ICSOBA-Aluminium of Siberia sessions of the speaker program on 4, 5 and 6 September included a total of 160 papers. The plenary session, including ICSOBA's 50 year festive session comprised the following presentations:

- Dr. Victor Mann, UC Rusal, Russia: UC Rusal - innovation in technology and development
- Prof. Barry Welch, New Zealand: The importance of fundamental understanding for high amperage high performance cell operation
- Prof. Peter Ployakov, SFU, Russia: Aluminium Industry of Russia – a historic overview
- Prof. Li Wangxing, Zhengzhou Research Institute of Chalco, China: Developments and future of the bauxite, alumina and aluminium industry in China
- Dr. Yanchen Wang, CRU International, United Kingdom: Developments in the global bauxite, alumina & aluminium industry
- Prof. Halvor Kvande, Norway: Trends in the global aluminium industry
- Dr. Frank Feret, ICSOBA, Canada: 50 years of ICSOBA
- György (George) Bánvölgyi, Hungary: Overview of ICSOBA papers in Alumina production
- Dr. György (George) Komlóssy, Hungary: History of ICSOBA in the direction of geology
- Michel Reverdy, Dubal, UAE: A historical review of aluminium reduction technology papers
- Katy Tsesmelis, International Aluminium Institute, UK: Recycling - an important part of the aluminium story.

Subsequently there were 11 presentations on Bauxite and bauxite resources, 45 on Alumina production, 45 on Aluminium reduction, 18 on Carbon and carbon materials and 23 on Casting in parallel sessions. Subjects were approached from a scientific or practical point of view and were presented either in English or Russian while the audience could listen to the simultaneously translated English or Russian version through their earphones. Accompanying slides were projected both in English and Russian language.

Papers and powerpoint presentations of this and previous conferences were available to ICSOBA members at no cost. ICSOBA has scanned all historic proceedings, the so-called Travaux volumes. Tables of contents can be consulted on the ICSOBA web-site at http://www.icsoba.info/downloads/proceedings-of-past-events and individual papers can be requested via email at icsoba@icsoba.info.

In addition to the registered delegates, about 200 visitors were attracted by round table discussions and the exhibition with 66 booths - 35 Russian companies and 31 from outside Russia, such as Altek, Andritz, BASF, Bokela, Bruker, Brochot, Buss AG, Cargotec, Cavemin, Claudius Peters, Danieli Corus, Eirich, Feluwa pumpen, Gouda Refractories, Hangzhou New Time Valve, Hazemag Group, Helmholtz, Hencon, Industrial Monitoring & Controls L.L.C , Luft und Thermotechnik Bayreuth, Mid-Mountain Materials, NALCO, NKM Noell Special Cranes, Outotec, Putzmeister Solid Pumps, Riedhammer, Sermas Industrie, Shandong Jingjin Environmental, Storvik, Thermo Techno Ltd, Fives Solios, Weir Minerals Netherlands and others.

On the morning of September 6th, delegates had the option of visiting UC Rusal's Krasnoyarsk aluminium smelter, the largest Söderberg smelter in the world, or the Krasnoyarsk hydro-electric dam with its 6000 MW power station.

In line with ICSOBA's tradition, the conference provided ample opportunity to meet old and new colleagues during excursions, welcome drinks, meals, a cruise on the Yenisei River and the grant closing banquet with cultural performances. NFM staff did a great job in organizing all logistics.

Dr Li Wangxing, vice-president of ICSOBA and president of Chalco's Zhengzhou R&D centre invited ICSOBA to hold its 2014 conference at the premises of this research institute with the support of

Chinalco. China's role in the global aluminium industry justifies a repeat of the successful ICSOBA 2010 conference in China. Further information can be found on the ICSOBA website or below, in the Call for Papers.

CALL FOR PAPERS 32nd CONFERENCE AND EXHIBITION ICSOBA

Organized by: ICSOBA

In cooperation with: CHINALCO

New Challenges of Bauxite, Alumina & Aluminium Industry and Focus on China


12-16 October 2014 Zhengzhou, China

REGISTRATION & FEE

You can find fee info and download the registration form after Nov. 2013 at ICSOBA web site pages starting at www.icsoba.info Alternatively you can send an email to icsoba@icsoba.info for receipt of registration form and payment information. After registration you will receive an invoice for paying by credit card or wire transfer.

Chinese potential delegates can find all information at www.rilm.com.cn, authored by ICSOBA.

CALL FOR PAPERS

The organizing Committee is inviting the submission of papers. Please contact us before writing your abstract. Enquiries and abstracts can be sent to icsoba@icsoba.info. Abstracts should include the title, the text not exceeding 200 words, and the author's name(s), affiliation, position and email address of the corresponding author.

Deadlines for abstracts and final manuscript sending

Abstract:	30 April 2014
Full Paper:	15 June 2014
Presentation:	30 July 2014

Abstract, final manuscript and presentation are to be submitted according to the *Author guidelines & template* that can be downloaded from ICSOBA's website.

ORGANIZING COMMITTEE

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Speaker program: Dr Jeannette See, Dr Yin Zhonglin, Dr Jianhong Yang, Dr Xiangqing Chen

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INVITATION

Dear Colleagues,

The International Committee for Study of Bauxite, Alumina & Aluminium (ICSOBA) has great honor to announce the 32nd International Conference and Exhibition of ICSOBA. The event will be held in the Zhengzhou Research Institute of CHALCO (China) from 12 to 16 October, 2014 in cooperation with Aluminum Corporation of China (CHINALCO).

Objectives of the Conference are:

- to review the status of bauxite, alumina and aluminium industries in the world with emphasis on China;
- to discuss promising research developments aimed at production, productivity and cost improvements;
- to highlight proposed Greenfield and Brownfield activities in the aluminium industry;
- to discuss developments in the field of environment and safety;
- to update market aspects of bauxite, alumina and aluminium and their products;
- to provide an excellent opportunity to interact with international experts, scientists, engineers, technology suppliers, equipment manufacturers and representatives of aluminium industries the world over.

Included in the program are technical excursions hosted by Zhengzhou Research Institute of CHALCO, namely visits to the nearby alumina refinery in Zhongzhou Branch of CHALCO and Jiaozuo Wanfang Aluminum Smelter.

We look forward to seeing you in October 2014 at the ICSOBA-2014.

Dr Frank Feret, President ICSOBA

Prof. Dr Wangxing Li, President ZRI

China Bauxite, Alumina & Aluminium Industry

China is the biggest producer and customer of both alumina and aluminum.

Birth of Chinese Aluminium industry took place in 1950's with the creation of Shandong alumina refinery. Since that time, about 35 alumina plants and 60 aluminium smelters were built in China using domestic and imported raw materials. Consequently, there are multiple refinery technologies in China, e.g., high temperature and low temperature Bayer process, sintering process, flotation-Bayer process and sweetening process. Absence of high quality local bauxites and strategic reasons led to creation of unique technologies to process domestic low grade bauxites and non-bauxitic raw materials such as fly ash.

The most modern smelters are built in China. Due to energy prices difference, primary aluminum capacity is shifting from the middle and the east to the north and northwest of China. And Greener industry chains are working. The implement of *Aluminum Industry Norms* will be significant to continue development of aluminum industry.

Technical field trips

The ICSOBA-2014 program provides for visiting:

Zhongzhou Branch of CHALCO is the fourth alumina refinery in China, which construction started in 1987, and operation in 1993. It has a capacity of 2,400 kt Al/a. There is the first flotation - Bayer alumina refinery production line with high silica bauxite and high sulphur bauxite. The Bayer process, sintering process and sweetening process are applied in the refinery.

Jiaozuo Wanfang Smelter is the first 300 kA prebake cell, which was researched and designed independently in China. It has a capacity of 420 kt Al/a, running with the lowest energy consumption in China.

PROGRAM

Speaker program

- Bauxite and bauxite resources
- Alumina production
- Primary aluminium production
- Carbon and carbon materials
- Aluminium products and alloys

Exhibition

During the Conference there will be a sizable (2000 m^2) Exhibition of latest technologies, equipment and other devices for the aluminium industry. Companies can give a presentation at the Exhibition.

Welcome drinks - Meet and Eat

On the evening of Sunday 12 October the Conference will kick-off with welcome drinks & snacks following registrations at the welcome desk.

In the tradition of ICSOBA all lunches & dinners during the speaker program are included in the program in order for you to have maximum opportunity to meet other delegates, at no additional charge.

Sightseeing visits

Delegates can visit natural landscape and human landscape near Zhengzhou after the field visit. You can contact the agency on the registration desk. Destinations are: Yuntai Mountain - World Geology Park and Luoyang or Xi'an: ancient capitals of several dynasties.

Language

Presentations will be held in English, and PowerPoint presentations will be shown in both English and Chinese. All papers and presentations will be translated by professional translators and published in English.

TECHNICAL PAPERS

History of the Aluminium Industry in Russia

Viktor Y. Buzunov[1], Andrey V. Panov[2], Petr V. Polyakov[3], Denis S. Zubritskiy[4]
[1]RUSAL, Director, Aluminium Technology, [2]RUSAL, Director, Alumina Technology
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Keywords: RUSAL, smelters, history, technology

Abstract

The paper is concerned with the history of formation of the aluminium industry in the Soviet Union and then in Russia. It deals with the main stages of development of alumina and aluminium reduction technologies and emphasizes the contribution of Russian and Soviet scientists to the study of different aluminum refining and reduction methods and the development of aluminium technologies. Also, the paper stresses the role of R&D institutes in designing smelters and alumina refineries. In addition, the paper discusses the process of construction of smelters in the Soviet Union and shows how much has been done in the industry over the last 100 years. Moreover, the paper shows the achievements made by the industry and the current trends for further development of technologies. The current state of RUSAL's smelters is given. Furthermore, the paper makes an assessment of the current directions of further development of the Company which will help RUSAL continue to be the leader in the aluminum production.

Introduction

Russian aluminium industry can trace its roots back to the pioneering achievements of Russian scientists including Nikolay Beketov, Pavel Fedotiev and others in aluminium smelting, as well as novel developments of Karl Josef Bayer further expanded globally as Bayer Process for alumina production. Today the Russian aluminium industry is consolidated into a vertically integrated company for the production of alumina and of primary aluminium, and research and development under the ownership of UC RUSAL (RUSAL).

According to 2011 data as reported by Bloomberg, RUSAL is ranked to be the largest primary aluminum producer in the world with over a 9% market share [1].

Table 1. UC RUSAL Aluminium Smelters in Russia

Smelter		Start-up	Technology	2012 production, kt
Bratsk Aluminium Smelter	BrAZ	1966	VSS (165.1kA)	997,430
Krasnoyarsk Aluminium Smelter	KrAZ	1964	VSS (173.5kA) PB (155.2kA)	997,900
Sayanogorsk Aluminium Smelter	SAZ	1985	PB (253.4kA)	536,250
Khakas Aluminium Smelter	KhAZ	2006	PB (321kA)	297,680
Irkutsk Aluminium Smelter	IrkAZ	1962	VSS (170.8kA) PB (310.3kA)	404,850
Novokuznetsk Aluminium Smelter	NkAZ	1943	HSS (102.2kA) VSS (153kA)	286,890
Bogoslovsk Aluminium Smelter	BAZ	1945	HSS (83.9kA)	100,050
Urals Aluminium Smelter	UAZ	1939	PB (160, 300 kA)	69,000
Volgograd Aluminium Smelter	VgAZ	1959	VSS (153.8kA)	167,610
Kandalaksha Aluminium Smelter	KAZ	1951	HSS (84.5kA)	71,230
Nadvoitsy Aluminium Smelter	NAZ	1954	HSS (81 kA) PB (87.5kA)	58,710
Volkhov Aluminium Smelter	VAZ	1932	PB (60 kA)	15,640
Taishet Aluminium Smelter*	TAZ		PB (RA 400)	785,000
Boguchany Aluminium Smelter*	BoAZ		PB (RA 300)	600,000
Total (except TAZ and BoAZ)				**4,003,240**

* The Taishet and Boguchany Smelters are currently under construction.

Currently, two of RUSAL's smelters use proprietary in-house developed RA 300 (300 kA) cell technology and one smelter has RUSAL's proprietary RA 400 (400 kA) cells in operation as part of the continuous cell development program. As can be seen in Table 1, the Taishet Smelter will use the RA 400 cell technology and the Boguchany Smelter will use the RA 300 cell technology similar to that at KhAZ.

Pre-1920's Russia

In the end of the 19th and the beginning of the 20th century, Nikolay Beketov (Figure 1), Pavel Fedotiev and other Russian scientists performed a series of studies, which have played a major role for the global aluminium industry. Nikolay Beketov in 1859-1865 developed a chemical method for producing aluminium by replacing Al with the more active magnesium. His method was very simple: crushed cryolite and magnesium metal chunks were put into a graphite crucible. The crucible was closed with the lid and placed in a coke furnace for two hours. After removing and cooling the crucible, shiny aluminium balls of small size were taken out of the crucible. The Beketov method was also used to design industrial technology for a plant in Hemelingen, Germany. From 1885 to 1890, using Beketov's technology, 58 tonnes of aluminium were produced which amounted to more than a quarter of aluminium produced in the world by a chemical method in the period from 1854 to 1890.

In the period from 1882 to 1892 years, an Austrian chemist Karl Josef Bayer (Figure 2), living in Russia, developed a method for producing alumina from bauxite (Bayer Process), which is now globally the predominant alumina production technology. In 1895, Dmitriy Penyakov proposed another method for producing alumina (by sintering bauxites with sodium sulfate in the presence of coal.) In 1914, aluminium was produced for the first time by using domestic raw materials. In 1916, Evgeniy Zhukovsky developed a technology to produce alumina from low-grade bauxite.

Under the supervision of Pavel Fedotiev (Figure 3), thorough studies of the theoretical foundations of aluminium reduction were conducted. In particular, the following was studied: aluminium fluoride, sodium fluoride, cryolite–alumina melts, aluminium solubility phenomena, among others related to the process of electrolysis of cryolite-alumina melts. The results of these studies received worldwide acclaim.

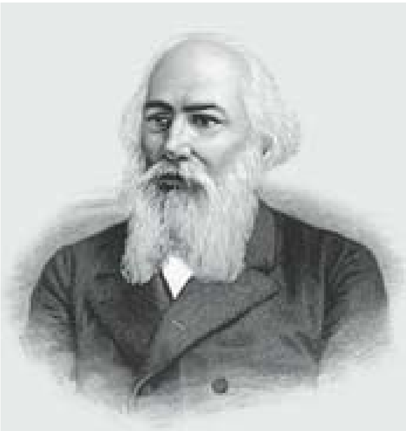

Figure 1. Nikolay Beketov

Figure 2. Karl Josef Bayer

Figure 3. Pavel Fedotiev

Development of the USSR Aluminium Industry

Early in the 1920's the USSR initiated a long-range program for the development of the "industrial" infrastructure to support the establishment of new industries and the expansion of the existing industries. The program included the erection of new power generating facilities and an electrical transmission grid to supply electricity in the Country. One of the results of this program was that the building of the first dam on the Volkhov River in 1926 that provided the electrical energy for the beginning of Russian aluminium industry. During 1929, Pavel Fedotiev continued his research on the reduction of aluminium from domestic raw materials and the design effort for the Volkhov aluminium smelter started. The Smelter project used the 23 kA technology. Anodes were supplied from Kudinovskiy Electrode Plant.

In 1930, a pilot plant was commissioned in Leningrad (currently Saint Petersburg) that ultimately played a substantial role in the development of the Russian aluminium industry. The plant was used for testing equipment, developing cell-operating processes and establishing standard procedures, as well as personnel training. A hydro chemical method for producing cryolite was developed in the Institute of Applied Mineralogy that became the basis for cryolite production at the Polevskoy cryolite plant.

In 1931, the All Union Aluminium and Magnesium Institute (VAMI) was created to implement all technology development and design for the production of aluminium. On May 14, 1932, the first metal was produced at the Volkhov aluminium smelter (Figure 4, 5) and this day is recognized the date of birth of the entire aluminium industry. Several years later, the Country stopped importing aluminium and up to the time when the USSR entered World War II, it was among the world leaders in the production of aluminum.

Figure 4.
Volkhov Aluminium Smelter, mid 1930s

Figure 5.
Volkhov Aluminium Smelter. Potroom №1

At the beginning of World War II, the decision was made to dismantle the aluminium smelters in the western part of the USSR and relocate them to the Ural Mountains and Siberia. The remaining aluminium smelters that were located in Urals and Siberia tried to increase production levels to meet the ever increasing demand, however the lost production of the western smelters could not be overcome. Ultimately, USSR, acquired about 301,000 tonnes of aluminium from the United States of America under a Lend Lease agreement to offset some of the lost aluminium production. Simultaneously, the domestic smelters continued to improve technology and the quality of aluminium. During World War II, in order to address the needs of the defense industry, a decision to increase the capacity of the Urals Aluminium Smelter, in addition to the building the Bogoslovsk and Novokuznetsk aluminium smelters was taken.

By July 1942, the capacity of the Urals Aluminium Amelter doubled and on January 7, 1943, the country produced the first Siberian metal at the newly erected Novokuznetsk Aluminium Smelter. The first alumina at the Bogoslovsk plant was produced on May 3, 1943 and in 1944, the Kamensk-Uralsk metallurgical plant was commissioned. On the Victory Day of USSR (May 9, 1945) the Bogoslovsk Aluminium Smelter produced its first aluminium.

In the postwar years, the industry developed rapidly. In 1959, VAMI developed a VSS cells with amperage of 130 kA. In 1966, VAMI developed a PB cell with amperage of 130 to 255 kA. New plants were built in Kandalaksha (1951), Nadvoitsy (1954), and Volgograd (1959). For addressing their needs in alumina, alumina refineries in Pikalevo (1959), Pavlodar (1964), Ganja (1966), Achinsk (1970) and Nikolaev (1980) were built. The first smelter operating with VAMI PB technology was commissioned in 1975 in the smelter which is now the Republic of Tajikistan.

The rapid development of the USSR after the war created increasing demand for aluminium to a point where the existing plants could not keep up with the demand leading to the decision to build new smelters. In 1962 Irkutsk Aluminium Smelter was started. Krasnoyarsk Aluminium Smelter (KrAZ), Bratsk Aluminium Smelter (BrAZ), and Sayanogorsk Aluminium Smelter (SAZ) were designed as the largest aluminium smelters in the world. For meeting their needs in power, the Krasnoyarsk, Bratsk and Sayano-Shushenskaya hydroelectric dams were constructed. The first metal at KrAZ was produced in 1964 (BrAZ – 1966, SAZ - 1985.).

The aluminium industry created in the USSR was one of the leading in the world. Soviet scientists became the first in the world to solve a number of important academic and engineering issues establishing unique alumina technologies in industrial scale (processing of low grade bauxites by serial combined Bayer-sintering method, complex waste free processing of nepheline ores and concentrates for the production of alumina, soda, potash, and cement; processing of alunite ores for the production of alumina, potassium sulphate, and sulfuric acid).

The serial combined version of Bayer-sintering method for processing low grade bauxites (A/S ~ 3) comprises Bayer processing and subsequent sintering of red mud and limestone to recover alumina and soda back to the process. This method was developed by Vladimir Mazel and other VAMI engineers and commercially applied in Pavlodar plant in Kazakhstan. Application of this method for processing of bauxite with high silica content increases alumina chemical recovery up to 93% of total Al_2O_3 content. This plant shows excellent efficiency and is one of the lowest cost producers.

VAMI Institute in USSR elaborated and implemented commercially the unique technology to process alunite ore into alumina, potassium sulfate, and sulfuric acid. The process was developed by Georgy Labutin and other VAMI engineers in 1953 and was used for engineering and construction of Kirovobad alumina refinery (present Ganja, Azerbaijan) with a production capacity of 150 000 t/y of alumina.

The development of the technology for processing of alkaline aluminosilicate ore started in USSR in early 1930’s in order to utilise the nepheline concentrates from the beneficiation of apatite-nepheline ores from Kola Peninsula, Russia. Development of basic technology was conducted in VAMI and GIPCH under guidance of F. Strokov, P. Vlodavetz, I. Lileev and others. In the middle of 1930’s it was decided to retrofit Volkhov alumina plant for processing of Kola nepheline concentrates but the work was interrupted by the war. Volkhov plant was converted to the process only in early 1950-ies. After mastering at Volkhov, the technology was further improved by VAMI and used for the construction of Pikalevo and Achinsk alumina refineries making them some of the most efficient alumina plants today.

The majority of alumina for the production of aluminium was produced in the European part of the country and in the Ural Mountains. The largest alumina refineries used bauxites from a number of locations (Boksitogorsk, Severouralsk, and Turgay.) To a lesser extent, nepheline ores from the Kola Peninsula, and Krasnoyarsk region were used.

Post-Soviet Period (1992-up to now)

In the early 1990’s, after the after the breakup of the USSR into separate Countries or Republics, the Russian aluminium industry was hit hard by an economic downturn. Moreover, supplies from the alumina refineries was severely interrupted because the refineries were located in countries that became independent such as Ukraine, Kazakhstan and Azerbaijan. The remaining Russian production facilities were only able to supply forty percent of the demand.

In the USSR, aluminium was considered a strategic material. As a result, aluminium exports were limited. Almost all the metal produced was consumed by the domestic market. In the early 1990's, the export ban was lifted, and a majority of the aluminum was sold abroad due to a decrease in the domestic consumption of aluminium from 17 to 2 kg per capita per year (Figure 6) and no investment was made to maintain or modernize the industry.

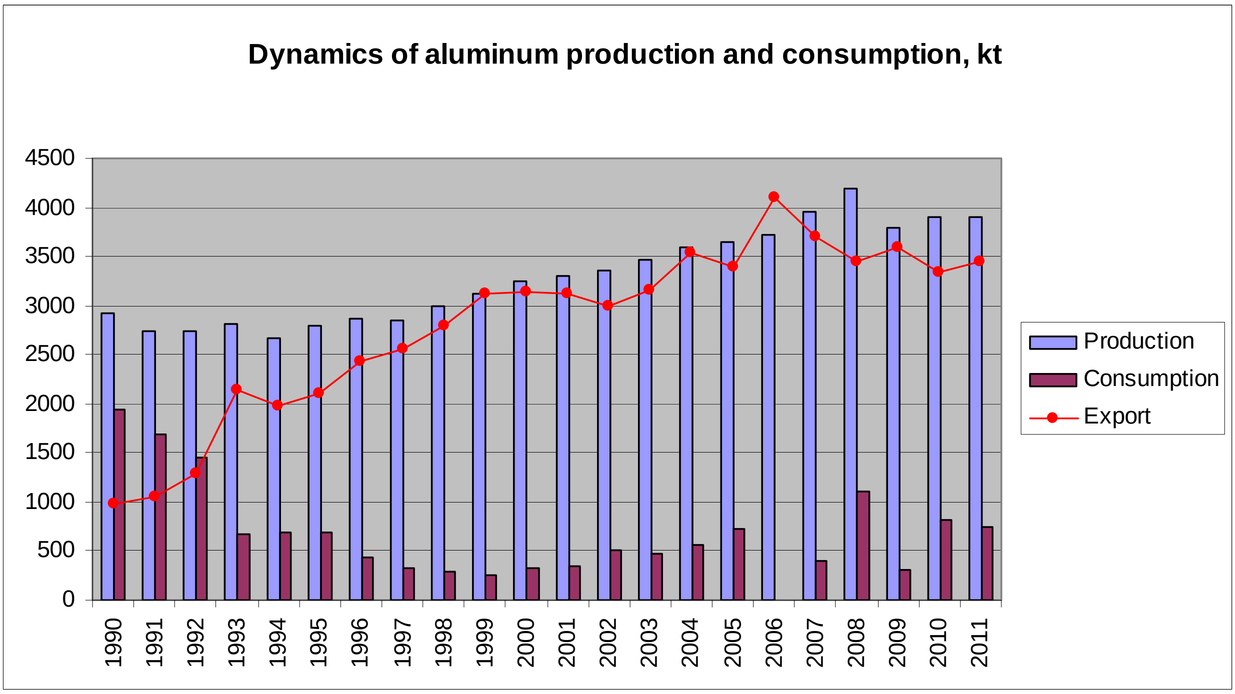

Figure 6. Dynamics of aluminium production and consumption in the Russian Federation [2]

In the late 1990's, the aluminium industry started the recovery and the consolidation of businesses started. In 1996 Siberian-Urals Aluminium Company (SUAL) was founded combining the assets of BAZ, VgAZ, VAZ, UAZ, NAZ, KAZ, IrkAZ and the alumina refinery in Pikalevo. In 2000 the assets of four Siberian smelters, in Bratsk, Krasnoyarsk, Novokuznetsk, and Sayanogorsk were combined and *Russian Aluminium (RUSAL)* was created.

RUSAL

From it's origin, RUSAL has set the ambitious task of building new plants on the basis of its own technology and retrofitting the existing facilities in order to increase their economic efficiency and environmental protection. To meet this goal RUSAL established in 2001 its Aluminium Smelter Technology R&D center in the city of Krasnoyarsk.

The existence of the center gave momentum to the development of own proprietary prebake cell designs. Within 10 years, from 2002 to 2012, the RA-300 and RA-400 high-amperage technologies were created and implemented at SAZ & KhAZ. In addition to high-amperage cell technologies, the center is upgrading the Søderberg anode technology.

Another step to decrease pressure on the environment, and at the same time to increase the efficiency of aluminium production, is RUSAL's inert anode technology that is currently under development. Once introduced, it will enable RUSAL to eliminate hazardous emissions and produce a tonne of oxygen for every 900 kg of aluminium manufactured.

In 2007, the merger between RUSAL, SUAL, and alumina assets of Glencore formed UC RUSAL In the same year, based on the RA 300 (300+ kA)and RA 400 (400+ kA) high-amperage cell technologies developed in the R&D Center, the construction of two new smelters, BoAZ (Figure 6) and TAZ was commenced.

Figure 7. BoAZ potroom № 1

Nowadays RUSAL is a leading global aluminium producer. The company's main products are primary aluminium, aluminium alloys, foil, and alumina. RUSAL is a completely vertically integrated aluminium company with assets right through the production process – from bauxite and nepheline ore mines to aluminium smelters and foil mills. RUSAL incorporates more than 40 plants in 13 countries, among them Aughinish Alumina, Friguia Bauxite and Alumina Complex, Queensland Alumina Ltd, Bauxite Company of Guyana, Armenal, Kubikenborg Aluminium AB (Kubal). This provides RUSAL with exceptional operational flexibility and enables it to control every stage of the manufacturing process ensuring the highest quality of products.

To meet the surging demand for aluminium, fuelled by the rapid growth of the emerging markets, RUSAL invests heavily in the expansion of its existing production capacities as well as into construction of new facilities. The access to rich bauxite deposits, both in Russia and in other countries, will enable RUSAL to meet its growing production demands.

Conclusion

Throughout its history, the Russian aluminium industry is showing steady growth and innovation. RUSAL, united all plants for aluminium production, continues this tradition.

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RTA CastPro™ Advanced Compact Filtration (ACF): Industrial Operation Feedback and Commercial Availability

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Keywords: Aluminum Processing, In-Line Treatment, Filtration

Abstract

The advanced compact filter (ACF) technology is the solution to a highly productive value added product casthouse. It redefines the economically viable batch sizes for high quality filtered aluminum cast products. Deep bed filters' (DBF) economical batch sizes are over a 1000 tonnes due to the residual hot metal in the bed between casts, its associated cost with respect to preparation and media as well as its incompatibility to handle on the go changes of alloys. The ACF enables the production of furnace size batches of highly filtered metal to qualities typically achieved by DBFs. Due to its operation reliability and its performance, the advanced compact filter has proven its ability to meet stringent users' quality requirements for a wide variety of alloys. The use of this technology improves productivity, flexibility, as well as the resulting operating costs of a casthouse.

In-line filtration, used to remove inclusions from the melt, is mandatory for the production of various aluminum alloys and products. Different technologies such as ceramic foam filtration, porous tube filters and deep bed filters are available depending on the metal cleanliness requirements of the products. The choice of equipment is driven by the product requirements according to filtration efficiency, cost and flexibility. Typical filtration efficiency by technology type is presented in Figure 1.

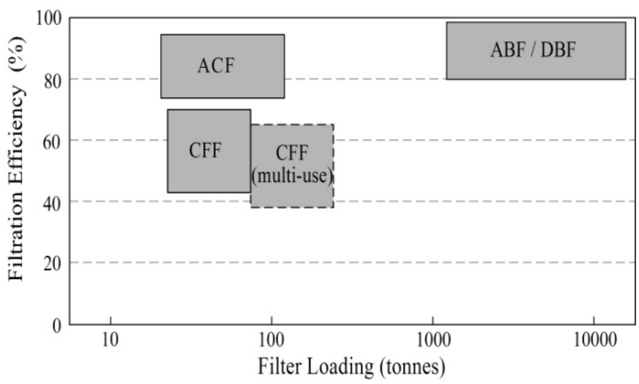

Figure 1. Efficiencies of different filtration technologies (ABF, CFF and ACF)

Owing to its high efficiency of typically greater than 90%, the deep bed filter or the Alcan bed filter (ABF) is commonly used for critical product applications such as can end stock (CES) and lithographic sheet. However, over thirty years of operating experience within Rio Tinto Alcan casthouses has demonstrated that deep bed filtration costs are high and can vary from 2 to 14$/mt, depending on the volume of metal that is filtered through each bed. The tonnage filtered through a DBF varies depending on alloy specification, molten metal origin, and the number of different alloys that are produced by the casthouse. Moreover, deep bed filtration technology reduces the casthouse operational flexibility. Due to the significant metal hold-up volume that is maintained between casts, the frequency of alloy changes is kept to a minimum, and rigorous planning of product orders is required. In addition, when producing high magnesium alloys, the tabular alumina beds must be "conditioned" with a more tolerant alloy to eliminate sodium pick-up from the new filter material. This is required more specifically on can end stock to avoid the formation of downstream fabrication defects such as edge cracks.

On the other hand, ceramic foam filters (CFF) are widely used for the production of a vast number of alloys and products such as foundry remelt ingots and general purpose sheet ingots. With filtration efficiencies varying from 30 to 90% [1,2], the CFF is limited to applications requiring moderate metal cleanliness. In addition, CFF filtration costs are relatively low and consistently fall between typically 2 and 4$/mt. This type of equipment does not require metal hold-up between casts nor bed conditioning, for high magnesium alloys, and therefore allows greater flexibility for alloy changes.

In order to meet the market demands of on-time delivery over a wide range of products and alloys, without compromising the stringent metal cleanliness requirements of different customers, there is a need for a flexible, efficient and low cost filtration technology that combines the best aspects of deep bed and CFF filtration technologies, while eliminating the inconveniences of both.

Consequently, a new apparatus and method, the advanced compact filter technology (ACF) (US 7,666,248), was developed at the Arvida Research and Development Centre of Rio Tinto Alcan to obtain inclusion removal efficiencies comparable to that of deep bed filtration, while offering a low cost and high flexibility similar to that of the ceramic foam filter.

ACF Equipment

Past studies have shown the benefits of finer pores [3-5,7] on standard CFF filtration efficiencies for 30 to 60 ppi filters (see Figure 2). Smaller pores increase the number of channels through the filter and therefore increase the filtration efficiency. In the same way, lower density and higher window openness also increase filtration efficiency [6].

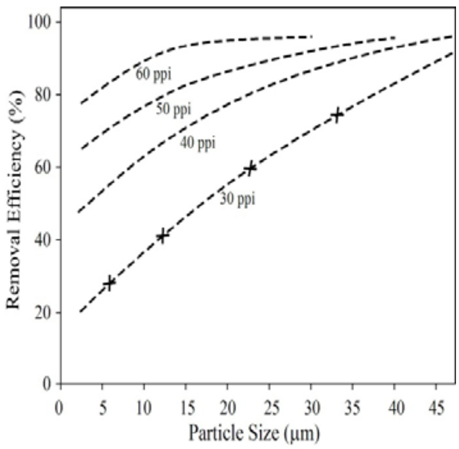

Figure 2. Filtration efficiency of standard CFF filter sizes (ppi) [7]

The morphology of the CFF is a compromise between permeability (resistivity to metal flow), filtration efficiency, mechanical strength and priming resistance. A morphology combining finer pores, lower densities and high window openness will increase the filtration efficiency. However, both the resistance to the metal flow and the pressure needed to initially prime the filter with molten metal will also increase. In typical casthouses, these two parameters are limited by the plant layout and more specifically, by the elevation difference between the furnace and the casting machine. Moreover, a priming pressure higher than 500 mm of aluminum is unpractical and not industrially viable. The ACF technology was developed to solve this problem and allows the use of higher efficiency ceramic filter morphologies.

Fundamental research was carried out at the Arvida Research and Development Centre (ARDC) in an effort to increase the filtration performance of a compact, single-use filter. Different filter morphologies were tested to obtain the filtration performance required for producing critical products such as can end stock. In partnership with Selee Corporation, a well-established ceramic foam filter manufacturer, a ceramic filter corresponding to the desired morphology and mechanical strength requirements was fabricated. This ceramic filter has a reticulated cell structure with fine pores, low density and high window openness providing excellent performance and an overall filtration cost similar to the standard CFF. However, the required priming pressure is too high for available industrial equipment.

The patented advanced compact filter (ACF) was development and industrialized by Rio Tinto Alcan to allow the use of such filter morphology. It provides an innovative means of reducing the required priming pressure on the filter. A vacuum is formed under the filter to increase the pressure differential between the upstream and downstream sides of the filter. This quick and instant vacuum provides ideal conditions for consistent and uniform priming, and reduces the metal priming depth requirement upstream of the filter. The ACF technology is adapted to the use of one or multiple filter cartridges. A schematic of the process showing an example of a multi-filter ACF is presented in Figure 3.

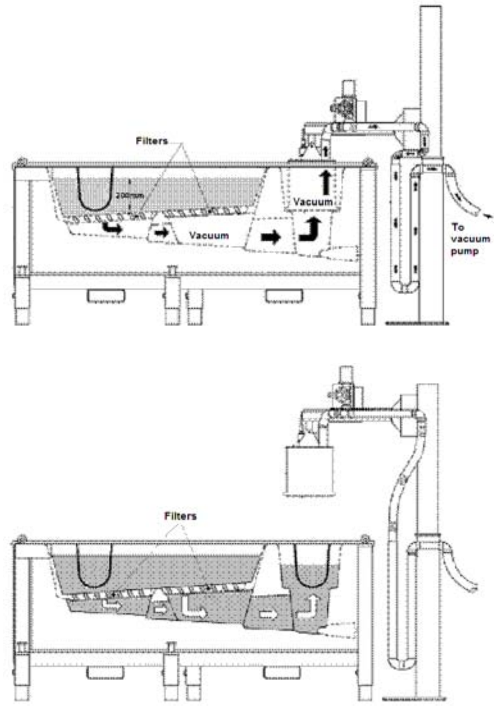

Figure 3. Priming mechanism of the ACF

At cast start, incoming molten aluminum covers the preheated filters in an adapted CFF bowl. The static pressure is insufficient to prime the filters. When a given upstream metal height is obtained, a vacuum reduces the downstream pressure under the filters. The resulting pressure gradient will prime both filters simultaneously. Once the priming is completed, filtration can take place in a fashion similar to that of a standard CFF, but with greatly improved performance.

An example of an industrial ACF unit is shown in Figure 4. This unit consists of an adapted CFF bowl that accepts two 23-inch ceramic filter cartridges, an hermetic outlet well that is designed to allow creation of the initial priming vacuum, a vacuum pump, a tap hole for metal drainage, an integrated preheating lid as well as process measurement and control equipment

Figure 4. The ACF filter in an industrial environment

The type of ACF ceramic filter that is used depends on the product cleanliness requirements as well as on other process parameters. It can be selected from a wide variety of morphologies ranging from coarse (20 ppi equivalent) to fine (80 ppi equivalent). For traceability and process control, the barcode of each filter is scanned by the casting operators. Once installed, a programmed preheating cycle is applied by means of a high excess air burner in order to obtain a uniform filter temperature, while avoiding hot spots and physical degradation of the filter. A cast can be started through the ACF only after PLC supervision determines that sufficient preheating has been obtained. At cast start, if required for the particular filter medium being used, the vacuum unit is lowered to seal the outlet well of the filter bowl. When a sufficient metal height is detected above the filters, a vacuum ramp between -0.1 and -10 kPa per second is applied to obtain consistent and uniform priming. Different vacuum ramps are used to optimize priming while avoiding any filter damage. When metal is detected in the outlet well, the vacuum unit retracts and filtration begins.

Filtration Performance

The industrial scale production of quality-critical products (such as AA5182 can end stock) using the ACF began, in 2010, at one Rio Tinto Alcan casthouse. This alloy was previously filtered using a DBF, which is the standard technology for the American canning industry. A complete characterisation of the filtration and ingot performance was carried out.

Can end stock is now filtered using the improved ACF filter morphology for cast weights of typically 100 tonnes. Vacuum priming is obligatory to initiate the casts. Filtration performance was characterised by taking LiMCA and PoDFA measurements upstream and downstream of the ACF. Inlet sampling was taken directly at the furnace outlet prior to any grain refiner addition and before degassing through the Alcan compact degasser (ACD). The outlet sampling position was approximately two meters downstream of the ACF. Spectrographic samples were also taken downstream of the ACF to detect potential sodium release from the filter material. Metal head loss across the filter was recorded continuously using laser measurement of the metal level in the trough at the furnace exit and downstream of the ACF.

During this work, it was found that the LiMCA measurements taken downstream of the ACF were influenced by the presence of microscopic gas bubbles of typically 20 to 40 µm in diameter that were entrained in the molten aluminum downstream of the in-line degasser. These bubbles pass through the ACF filters and artificially increase the downstream N20 value, thus reducing the calculated filtration performance of the ACF. To quantify this effect, a series of casts were carried out during which time the ACD degasser was removed from the trough at mid-cast. LiMCA readings taken after the ACF were analysed and corrected, if needed. Uncorrected values are presented in this paper, except if stated otherwise.

Typical LiMCA measurements, for one cast of can end stock, are presented in Figure 5. The filtration efficiency is stable during the entire duration of the cast. No inclusion releases were detected. The filtration efficiency of the ACF was calculated as follows:

$$\text{Filtration efficiency} = \frac{(N20_{Furnace} - N20_{ACF})}{N20_{Furnace}} * 100 \quad (1$$

LiMCA metal cleanliness results for 32 casts of can end stock alloy AA5182 are summarised in Figure 6. A filtration efficiency of 96.4% was obtained with an average corrected N20 count of 1.6 k/kg. Additional results comprising over two hundred PoDFA measurements taken during twenty casts of the same alloy are summarized in Figure 7. In this case, an additional sampling position was considered between the degasser (ACD) and the ACF.

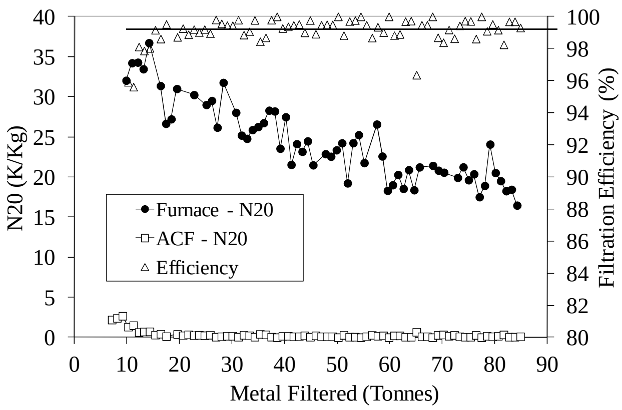

Figure 5. LiMCA data for a typical cast of CES

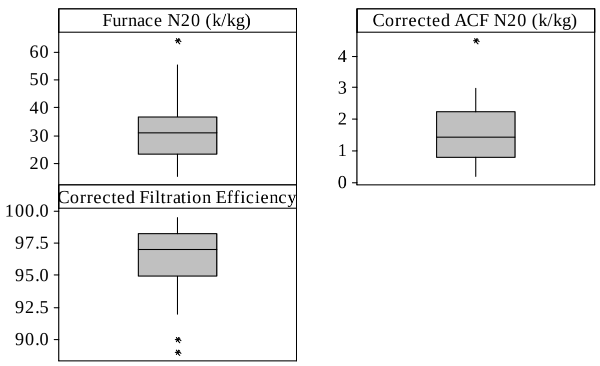

Figure 6. Metal cleanliness: LiMCA N20 count across the ACF

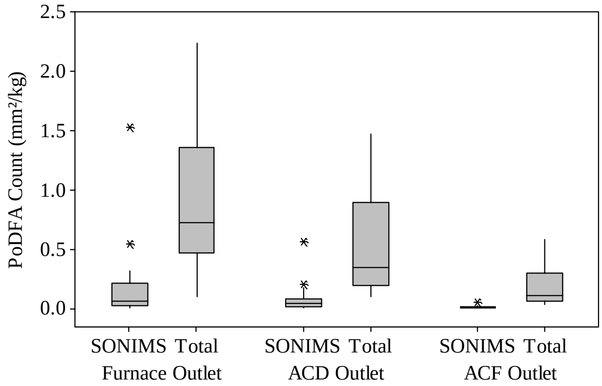

Figure 7. PoDFA count across the process

PoDFA SONIMS (hard particles) results reveal an efficiency of 92% with an average inclusion count of 0.006 ± 0.014 mm²/kg after the ACF, which is in agreement with the efficiency measured using LiMCA. This filtration performance as well as the absolute LiMCA and PoDFA values allows a transparent process change from deep bed to ACF filtration technologies with respect to downstream product performance at the rolling mill and at the can maker. In addition, for high magnesium alloys, the sodium release from the ACF was maintained below the North American specification without change to either the furnace or in-line alkali removal processes. From January 1st 2010 to May 31st 2013, over 237,000 tonnes of aluminum were produced using the ACF technology including 80,000 tonnes of can end stock AA5182. No difference is noted with respect to several quality issues that lead to rejected metal, either in the casting pit, or at the rolling mill.

The ACF also shows excellent resilience to process fluctuations. Average furnace N20 cleanliness levels varied from 15 to 64 k/kg. Nonetheless, stable metal cleanliness is maintained downstream of the ACF. The metal head across the filter remains stable during the casts, as shown in Figure 8. A linear increase in metal head is to be noted, which is typical of the depth-mode filtration mechanism as opposed to cake-mode filtration.

As shown in Figure 9, the metallostatic head loss across the ACF is stable cast after cast and stays within the limits dictated by the physical layout of the casthouse.

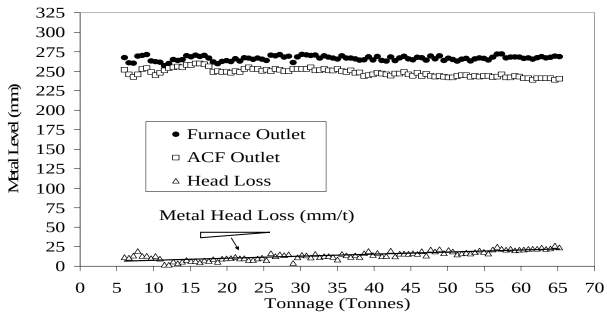

Figure 8. Typical metal head loss across the filter

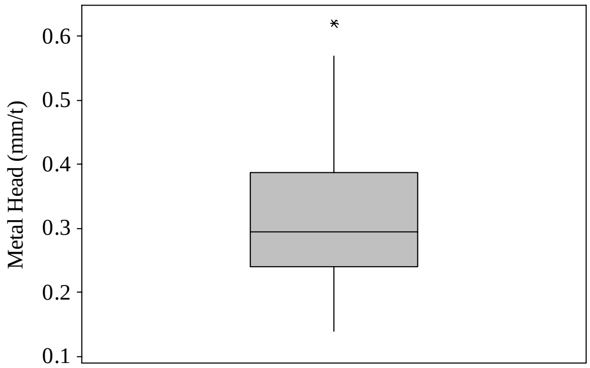

Figure 9. Historical range of the metal head loss across the ACF (124 casts)

Operational Advantages

ACF technology has four main advantages over DBF technology: no servicing equipment, lower operational cost, higher flexibility and technical/operational follow up, all while maintaining similar filtration efficiency.

Normally, the ACF will replace the DBF as the final quality process equipment before casting. It is designed to be installed as a ¨plug and play¨ unit with few related equipment, unlike the DBF which requires a preparation, pre-heating and cleaning station as well as close follow up depending of the alloy produced. As expected, the ACF will require normal preventive maintenance as any other casting equipment. With good planning, the installation of the ACF in an operating casthouse is quite rapid, and in case of a problem, it is possible to go back to any filtration unit.

Different elements affect the actual filtration costs of an equipment: the filtration media, filter life, turnaround time, manpower needed for its preparation and/or cleanup, and used media disposal. For deep bed filters, the tabular alumina and other refractory consumables need to be changed every 1200 to 4000 tonnes of production depending on the alloys and molten metal cleanliness. To do so, the DBF must be drained and then removed from the production lines for cleaning and preparation. During this period, another DBF box must be installed on the line for production. Typical consumables, costs, and manpower needed for a DBF approximate 15 000 CAN$ for each bed. The total filtration cost therefore varies from 2 to 14$/mt. Moreover, two DBF boxes are needed on a single production line to allow filtered production during cleaning and preparation of the new bed. On the other hand, the ACF requires only ceramic tiles to be changed at every drop. Filter prices varies from 50 to 150$ depending on filter grades and chemistry. Two ceramic tiles can filter 100 tonnes of aluminum, thus a filtration cost between 2 to 4 $/mt. The ACF ceramic bowl has an extensive life if the proper procedures are applied. When a bowl change is required, a prebaked filter bowl can be replaced within 24 hours. No extra ACF unit is therefore required.

For casthouses producing many different alloy families, production flexibility can greatly reduce production costs and improve product mix. When using a DBF, the production line is limited to one alloy family in order to avoid alloy transition in the DBF. In other words, the production length and volume of a specific alloy or alloy family must correspond to the DBF life in order to minimize filtration cost. This restriction impacts different aspects of the casthouse. First, production lots are not adapted to the client need but to the DBF life. Therefore, the ingot inventory will increase in order to absorb the difference. Second, the production line is limited to a specific alloy. This can affect on-time delivery by delaying the production of another order after the DBF production sequence. If not, a large amount of scrap must be generated to clean the DBF and filter the new alloy. Third, DBFs are not adapted to small quantity orders for niche markets with high premiums because filtration cost would be extremely high. For example, a DBF cannot be installed for a 400 tonnes order. The ACF does not require a minimum production lot as its filtration media is changed at every cast. Therefore, the production lots are adapted to the client's need, thus reducing inventory and improving on-time delivery without scrap generation. If needed, alloys can be changed at every cast. Moreover, it can produce small orders for niche markets that need high filtration efficiency with no effect on its production cost.

The 5xxx series market also creates a problematic while using a DBF. Tabular alumina contains sodium which is released in the molten aluminum by the action of magnesium. An excess amount of sodium generates edge cracks at the rolling mill. Therefore, conditioning alloys must be used to eliminate the sodium from the tabular alumina. Normally, the first 300 to 500 tonnes produced by a DBF must be a non-critical 5xxx series alloy, which is a limited and low premium market when compared to can end stock AA5182. If no alloys are found, a large amount of scrap is generated at the beginning of each DBF bed. Moreover, these 300 to 500 tonnes decrease the actual DBF life, which greatly increase the efficient filtration cost. For the ACF, no conditioning is needed. Critical 5xxx series alloys such as CES can be produced without conditioning, thus improving once more the flexibility and reducing filtration costs and scrap generation.

Filtration efficiency of a DBF will vary depending on the alloys filtered and will evolve during the bed life. Bed preparation must be thoroughly followed by technical staff to guaranty the filter performance and life. Moreover, a DBF must be followed during its life by the technical staff to determine the opportune moment to replace the media. The ACF integrated a control system that reduces the involvement of the technical staff at the plant. The filtration media is 100% inspected and certified by the supplier. The casting parameters are recorded and processed to identified variations and potential issues. This information is summarized and provided to the technical staff for review. The filtration process and control is automated and therefore easier to use.

In summary, the ACF is robust to alloy order changes as well as to production changes. It does not need conditioning while producing 5xxx series alloys. The filtration cost will therefore remain low and will not be affected by the alloy mix and alloy sequencing. Moreover, it will help to control inventory, on-time delivery and will give access to niche markets. Finally, the ACF process parameters are automatically controlled, therefore facilitating its use and reducing the involvement needed by the technical group at the plant.

Conclusion

A new patented technology, the advanced compact filter (ACF), was developed and industrialized by Rio Tinto Alcan. This confirms the importance of the R&D at Rio Tinto Alcan and the importance of continuously improving our casting technology and equipment. This new technology provides filtration performance similar to that of deep bed filters and has proven its efficiency and robustness by producing over 80,000 tonnes of can end stock material. Can body was also produced within our customer specifications. Owing to the fact that there is no metal hold-up between casts, the ACF has a positive impact on the casthouse flexibility by allowing quick and frequent alloy changes without scrap generation. Production lots are adapted to the clients' needs, hence reducing inventory and contributing to on-time deliveries. Finally, the operation costs of the ACF are of the same magnitude as that of a standard CFF and much lower than a DBF.

Acknowledgements

The authors wish to thank Rio Tinto Alcan for permission to publish the present paper. The authors also want to acknowledge the collaboration of the Laterrière casthouse during the development of this technology. Special thanks are given to Dr. Joseph Langlais, Mr. Denis Bernard, Mr. Sébastien Leboeuf Mr. Serge Munger, as well as the many other researchers involved, all of Rio Tinto Alcan, for their active contribution in the development of the ACF technology. Finally, the authors acknowledge the engineering work done by STAS Inc. in the fabrication of the ACF units.

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ICSOBA MATTERS

Highlights of the year (between Belem and Krasnoyarsk conferences)

- Very successful conference took place in Belem, Brazil in September 2012, in which close to 300 delegates participated, 110 papers were presented and which was supported by numerous sponsors
- TRAVAUX volume corresponding to the Belem conference was published
- The Council was expanded by additional members (11): Bernard Allais, Jeffrey Best, Bhagyadhar Bhoi, Reinhard Bott, Wagner Brancalhoni, Francois Crevier, Wanchao Liu, James Metson, Chitta Ranjan Mishra, Andre Pelland, Sankar Sankaranarayanan, and Suziany Rocha de Souza
- Dr Li Wangxing was formally added to the ICSOBA board of directors
- The Payment Policy was revised
- Choice of site for the 2014 ICSOBA conference was settled (Zhengzhou, China)
- President represented ICSOBA at the annual Metals Bulletin (MB) event in Miami, Florida in March 2013. A dedicated pamphlet promoting Krasnoyarsk conference was produced and distributed among participants
- Media Partnership was established with Industrial Minerals and Metal Bulletin's Bauxite Event. Logo of each is displayed on respective websites
- Marketing partnership agreement was established between ICSOBA events and AlCircle
- An article about the ICSOBA 2013 conference was published in Aluminium Industry Today (AIT), The Journal Aluminium Production and Processing
- Two NEWSLETTERS were issued (December 2012, June 2013) and circulated to members and others
- The remaining TRAVAUX volumes, from past conferences and symposia were electronically scanned and are available for members as searchable pdf files
- ICSOBA's past fiscal year (2012) and corresponding financial activity was revised by P. Bussiere – public accountant in Quebec. The financial statement was filed with Revenue Canada and Revenue Quebec. The Revenue Canada and Revenue Quebec confirmed that ICSOBA does not owe any tax for 2012
- ICSOBA's Annual Report (2012) and bylaws were filed with Industry Canada and Registraire des entreprises Québec
- 300 small pins with ICSOBA logo and 55 bronze-based anniversary medals were designed and manufactured
- Three communications highlighting ICSOBA and its mission were published in international journals (Brazil, China and Russia)
- Important effort was made with the organisation of the 2013 ICSOBA conference in Krasnoyarsk. The effort resulted in large and diversified number of papers and participants.

ICSOBA Medals

At the last year's (2012) ICSOBA symposium in Belem, Brazil, the Awards Committee was formed. On the occasion of the ICSOBA 50th anniversary this year, the Awards Committee decided to produce commemorative pins and medals. The pins were distributed to all ICSOBA participants of the 2013 conference in Krasnoyarsk. For the 50th anniversary of ICSOBA a new medal, which features elements from the past two designs, was produced (see the Figure below).

The new "ICSOBA Commemorative Medal" is 70 mm in diameter. On one side there are the embossed portraits of Pierre BERTHIER (1782-1861), member of the French Academy, discoverer of bauxite; Karl Joseph BAYER (1847-1904), inventor of the Bayer alumina manufacturing process; Paul Louis Toussaint HEROULT (1863-1914) and Charles Martin HALL (1863-1914), inventors of aluminium-electrolysis, together with their names and dates of birth and death. On the other side there are the emblems of ICSOBA and the World, the full ICSOBA name, the name of the person awarded and the year and place of ICSOBA commencement.

As in the past, the "ICSOBA Commemorative Medal" constitutes a special award and may be awarded to not more than a few persons on the occasion of ICSOBA International Meetings. The medal may be awarded to those members of ICSOBA who achieved significant scientific or practical results within the field of action, or who notably strengthened its organization or promoted its international scientific and industrial cooperation. The name of the awarded person is to be inscribed on the medal, and the awarding event should be published in the NEWSLETTER. The "Commemorative Medal" does not carry any pecuniary reward.

Gold medals for past-presidents

At the opening session of the Krasnoyarsk conference the first two recipients of ICSOBA medals were: Dr György Komlóssy and Dimitri Contaroudas. Komlóssy and Contaroudas were the ICSOBA presidents for the period of 1993 – 1998 and 2003 – 2008, respectively, assuring its prosperity and growth. Thanks to the sacrifices they made, the chances they took and the patience and persistence applied – ICSOBA is a better organization at present.

Bronze medals

The "50 years of ICSOBA" bronze medal was awarded to Prof. Dr Peter Polyakov for welcoming ICSOBA to Krasnoyarsk and for giving all necessary support, resulting in a highly successful joint

ICSOBA & NFM conference. His promotion of the industry's scientific and professional goals resulted in building bridges of international understanding and cooperation.

The "50 years of ICSOBA" bronze medal was awarded to Dr Viktor Buzunov for helping ICSOBA expand its forum to carbon and electrolysis area and for his contributions as session organizer & chairman in the recent past.

The "50 years of ICSOBA" bronze medal was awarded to Dr Andrey Panov for his long term contributions to ICSOBA as vice-president, for preserving the TRAVAUX heritage online, and for outstanding inputs to conference programs.

The "50 years of ICSOBA" bronze medal was awarded to Marja Brouwer for her exemplary contributions to ICSOBA as treasurer and conference organizer, for assuring ICSOBA continuity and its sound financial health.

Bronze medals for the plants

The "50 years of ICSOBA" bronze medal was awarded to Achinsk Alumina Refinery and to Khakas Aluminium to commemorate the visit by ICSOBA delegates during the joint ICSOBA & NFM conference in Krasnoyarsk in September 2013.

The 2013 medal recipients: Dr Andrey Panov (first from left), Dr Peter Polyakov (third from left), Marja Brouwer (fourth from right), Dr György Komlóssy (third from right) and Dimitri Contaroudas (first from right)

Others in the picture: Dr Jeannette See (second from left), Dr Frank Feret (fourth from left) and Dipa Chaoudry (second from right)

Internal organisation

The International Committee for Study of Bauxite, Alumina & Aluminium is an independent association that unites industry professionals representing major bauxite, alumina and aluminium producing companies, technology suppliers, researchers and consultants from around the world.

ICSOBA belongs to its members and since the members elect the Board of directors in the Annual Meeting during an ICSOBA Event, members determine the policy of ICSOBA. ICSOBA currently has 238 members.

Membership

ICSOBA provides members with a platform to exchange technical information with each other. Upon their request individual members who are consultants or advisors to the aluminium industry, will be enlisted on the designated Consultants page on the website.

Companies can support ICSOBA by becoming Corporate member. Corporate members are shown in every Newsletter and listed on ICSOBA’s web site. Corporate members can nominate two employees who have the same rights as individual members, such as reduced event delegate registration fee, Newsletters and voting rights. Digital proceedings can be made available to all employees at the company’s intranet, and corporate members can sponsor ICSOBA events at the reduced sponsor fee.

	INDIVIDUAL MEMBERS	CORPORATE MEMBERS
Reduced Sponsor rates at ICSOBA Events		Yes
Reduced delegate registration fee for ICSOBA Events	Yes	Yes for 2 nominated employees
Name listed in ICSOBA's website	In Consultants page upon request	In Corporate Members page with link to web site
Right to vote on ICSOBA matters and eligibility for Presidency and Council	Yes	Yes for 2 employees
Receive a digital copy of a full paper or full proceedings of a past ICSOBA Event	Upon request	Upon request
Biannual Newsletter with articles from members, news and statistics	Yes	Yes to 2 employees. Company mentioned in Newsletters
Annual fee (from July to July)	C$ 100	C$ 500

You can find an application form for individual membership and corporate membership on ICSOBA’s website. You can also renew or apply for individual membership together with your registration for an ICSOBA event.

Public relations and Communication

Website

Printed proceedings of past ICSOBA events, the so-called Travaux volumes, have been scanned to separate searchable pdf files. There are a few exceptions, these are being searched and scanned as soon as possible. The Tables of Contents of the scanned Travaux volumes have been made public on the website http://www.icsoba.info/downloads/proceedings-of-past-events. ICSOBA members can obtain digital versions up to 20 papers each year at no cost by sending an email request to Dipa icsoba@icsoba.info. Additional papers are charged for $ 20 each.

Your feedback to make the website more attractive is welcome.

ICSOBA's executive office

Not only requests for past proceedings, but all inquiries sent to ICSOBA, whether by email to icsoba@icsoba.info or by phone to + 91 982 328 98 17, are addressed by Ms. Sudipta (Dipa) Chaudhuri in Nagpur, India.

Also mailings and the underlying database of ICSOBA's contacts are taken care of by Ms Dipa Chaudhuri in the executive office.

Corporate members

Currently ICSOBA has the following Corporate Members. For more details including links to the company's website, please refer to the member section of the website: http://www.icsoba.info/about-us/corporate-members

AMBER DEVELOPMENT	www.amber-development.com
BOKELA GmbH	www.bokela.com
BOSKALIS International BV	www.boskalis.com
COLT International BV	www.coltsmelters.com
DUBAL Aluminium Co Ltd.	www.dubal.ae
Hangzhou NEW TIME Valve Co Ltd	www.hzntfm.com
HATCH Associates	www.hatch.ca
HINDALCO Innovation Centre	www.hindalco.com
NALCO India Limited,	www.nalco.com
OUTOTEC Pty Ltd	www.outotec.com
RIO TINTO ALCAN	www.riotintoalcan.com
Shandong JINGJIN Filter Press	www.dmxs-com@263.net
STC Engineering GmbH	www.stc-engineering.de
WESTECH Process Equipment India P.Ltd	www.westech-inc.com
WEIR Minerals Netherlands BV	www.weirminerals.com