

**INTERNATIONAL COMMITTEE FOR STUDY OF
BAUXITE, ALUMINA AND ALUMINIUM
ICSOBA
NEWSLETTER**



A biannual publication

Volume 15 – June 2016

CONTENTS

CONTENTS	2
FOREWORD	3
NEWS AND EVENTS	4
ICSoba 2016 Conference.....	4
TECHNICAL PAPERS	8
Aluminium in the Periodic Table	8
New Progresses on Utilization of Red Mud in China	11
ICSoba MATTERS	15
ICSoba Financial Situation	15
Detailed Information (Monograph) on Laterite and Bauxite of Madhya Pradesh, India.....	17
Public Relations and Communication	17
Website.....	18
ICSoba’s Executive Office.....	19
Corporate Members	19
A series of books.....	20

The picture on the front page shows the Quebec City, Canada.

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:
 128 Des Fauvettes, St. Colomban, Quebec J5K 0E2, Canada
 Corporations Canada, Ontario under number 802906-7, and
Registraire des entreprises, Quebec under number 1167982181.

FOREWORD



Dear ICSoba Members,

At the time of printing this foreword, we are only three and a half month ahead of our next conference which will be held in the Hotel Palace Royal in Quebec City from 3rd to 6th October. The program organizers already received numerous abstracts and I encourage those of you who didn't to lodge yours before the end of June deadline.

Our Aluminium Industry is suffering, as the whole commodities market, from significant and lasting downturn. It looks like, after the commodities "super cycle", driven mainly by the Chinese infrastructure and equipment development, the market is heading towards a "new normal" situation, with sluggish LME price without any sign of recovery.

This situation triggers all the aluminium producers, followed by their equipment suppliers and other business partners, to launch cost saving initiative in order to preserve their profitability and their investment capacity.

Research and Development is always in the line of fire in this kind of situation and often short term cost saving hampers medium and long term new technologies development having the potential to create more value for our industry.

I feel it's about time for our industry to recognize the "new normality" also in the field of technology development and to start moving

towards more and more collaborative activity to share development cost and bring new development sooner to the market. At ICSoba, we are aiming to play a role in this evolution by bringing together scientist, operation and management colleague in a conference organized by Aluminium Companies, Suppliers and interested individuals for the same.

ICSoba is a truly international organization, having representatives from EGA, RTA, RUSAL and Votorantim in its Board of Directors. ICSoba is also one of, if not the only one organization, bringing its conference on the home turf of its members having recently visited Goa (India), Belem (Brazil), Krasnoyarsk (Russia), Zhengzhou (China) and Dubai (UAE) and thus providing unique opportunity for local contributors to take on the stage and share their success or their challenges.

Exceptionally this year, ICSoba is teaming up with REGAL (Quebec Aluminium R&D centers associations) which will give to the delegates opportunity to hear presentations, view and discuss around posters with young students working on topics related to our industry.

Participating in an ICSoba meeting is not only rewarding for the delegate but more importantly it is also of high return for delegate's companies through the know-how they brought back home from these few days.

As of this 34th ICSoba conference, I would like to extend my best wishes, on behalf of ICSoba Directors and of Rio Tinto Aluminium, to all of you for an enjoyable and successful conference in Quebec City.

With my best regards,

Claude Vanvoren
President of ICSoba

NEWS AND EVENTS

ICSoba 2016 Conference

The ICSoba-2016 Conference and Exhibition is organized by ICSoba in cooperation with Rio Tinto and Regal, and will be held in the Hotel Royal Palace in Quebec City, Canada from 3rd to 6th October, 2016. Some practical informations you can see below. For more information, please visit the website (www.icsoba.org).

Registrations

Please note that registration deadlines are fast approaching.

July 15: To enjoy the early bird registration fee

July 15: For registration with business visa support

August 30: For registration of a paper presenter

August 30: For booking a booth

A limited number of rooms have been reserved at Palace Royal hotel, downtown Quebec. Make sure that you do not delay the booking!

Not everybody likes to enter personal details and conduct financial transactions over the internet. Some corporate credit cards do not work with PayPal either.

If you would prefer to submit a form rather than enter your details over the internet, all you need to do is download ICSoba 2016 registration form from the ICSoba website ([www.ICSoba.org/ICSoba 2016/Registration](http://www.ICSoba.org/ICSoba%2016/Registration)). It's set up so you can fill it in on your computer and email it directly to us. No need to print and scan.

See you in Quebec!

Visa Support

Delegates who may have difficulty obtaining visa can count on ICSoba support.

Arrangements regarding visa support have been made with Rio Tinto. The applications for visa will be collected by ICSoba secretariat (Dipa) until 15 July. The applications obtained will be sent to Rio Tinto for subsequent dealings with the appropriate Canadian agency.

After 15 July please contact Frank Feret (ICSoba CEO) at feretfr@gmail.com for a letter of support.

Important information for travelers to Canada from countries where no Canadian visa is required

Apply for an Electronic Travel Authorization (eTA)



Government
of Canada

Gouvernement
du Canada

ETA is a new requirement at the entry to nationals of the countries entitled to visa-free travel when traveling by air to Canada. ETA is electronically connected with a passport and is valid for five years or until the expiry of the validity of your passport depending on whichever is shorter.

<http://www.cic.gc.ca/english/visit/eta-start.asp>

To complete the online form, you need:

- a valid **passport** from a visa-exempt country
 - You cannot apply using a Refugee Travel Document, Emergency Travel Document, Organization of American States (OAS) Travel Document or a UN Laissez-Passer.
 - If you are a **lawful permanent resident of the U.S.** and you do not have a passport, you **can apply for an eTA** with:
 - a valid U.S. Refugee Travel Document (I-571)
 - a valid Permit to Re-Enter the United States (I-327)
- a credit card
 - Visa®, MasterCard®, American Express®, or
 - a pre-paid Visa®, MasterCard® or American Express®,
- and a valid email address.

You can only apply for one person at a time. For example, for a family of three people, you will need to complete and submit the form three times.

Reminder

You **cannot apply for an eTA** if you are:

- a Canadian citizen or a dual Canadian citizen,
- a Canadian permanent resident, or
- a U.S. citizen. (However, lawful permanent residents of the U.S. need an eTA if travelling by air.)

Answer a few questions to make sure that you need an eTA and then continue directly to the form to apply for one online.

Application for an Electronic Travel Authorization (eTA)

<https://onlineservices-servicesenligne.cic.gc.ca/eta/welcome?lang=en>

Retired & Student Incentives

Beginning this year ICSOBA offers great incentives for retired delegates and for students (including post docs) to attend the conference. From reduced fees to free meals to award opportunities, students can receive all the benefits the conference has to offer at a low cost. **Reduced registration is \$400** for a full length of sessions and exhibits, and also includes a student lunch on Monday afternoon with the organizing committee and delegates. Best student poster awards will be distributed among the winners.

Program of the 34th ICSOBA & JER (Regal's Students Day) Conference and Exhibition

The event in Quebec will begin on 3 October 2016 with the official opening ceremony of the congress and exhibition, followed by a plenary session consisting of lectures on subjects relevant to the aluminium metallurgy and mining industries. In the afternoon REGAL' poster session will commence.

The hourly program of the 34th ICSOBA & JER Conference and Exhibition.

Hourly Program - 2016 ICSOBA & JER Conference in Quebec

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	
Hours	2-Oct	3-Oct	4-Oct	5-Oct	6-Oct	7-Oct	
7 - 8		Registrations					
8 - 10		Keynote session	Technical Sessions	Technical Sessions	Field trips to the plants	Director's Meeting	
10 - 10:30		Coffee	Coffee	Coffee		Coffee	
10:30 - 12		Keynote session	Technical Sessions	Technical Sessions		2017 Program organizers meeting	
12 - 13		Lunch	Lunch	Lunch		Lunch	
13 - 14			Technical Sessions	Technical Sessions			
14 - 15:30	Guided sightseeing tour of Old Quebec	Director's Meeting	JER Oral presentations (3)	Technical Sessions			
15:30 - 16		Registrations	Poster (Coffee)	Coffee		Coffee	
16 - 16:30			JER Oral presentations (2)	Technical Sessions			
16:30 - 17			Poster	Members meeting		Technical Sessions	
17 - 17:30							
17:30 - 18:30	REGAL annual meeting		Announcement of poster prices				
18:30 - 19							
19 - 19:30			Dinner for 2016 organizers & sponsors	ICSOBA Gala Dinner			
19:30 - 20							
20 - 21	Opening cocktail + Light buffet						

As you can see from the program this year ICSOBA joins forces with REGAL. The Centre for Research on aluminum - REGAL is a strategic combination that focuses on research around the aluminum material, its primary production development shaping processes and design to devise new alloys. A synergy is created by bringing together researchers from seven Quebec's educational institutions,

SMEs, large companies and various socio-economic players in this industry. REGAL brings together 36 university professors (regular members), staff from the public and private sectors, as well as a hundred students. In this regard, REGAL continuously recruits students for master's projects, doctoral and post-doctoral assignments attached to different departments of the participating universities. Several obtain a postdoctoral internship or work as a research assistant. Their research work is presented during JER events (journée des étudiants REGAL).

In the **keynote session** on Monday morning, 3 October, you will listen to 6 presentations by distinct speakers:

1. *Claude Vanvoren (Vice President Technology, R&D – Rio Tinto)*
2. *Johan Maljaars (Professor at TNO, Eindhoven University of Technology)*
3. *Jean Simard (President - Aluminium Association of Canada)*
4. *Ron Knapp (Secretary General - International Aluminium Institute)*
5. *Rafael Vieira da Costa (Vice President, Technology - Hydro - Bauxite & Alumina)*
6. *NALCO speaker*

Plant Visits

Arvida Aluminium Smelter, AP60 Technology Centre

Located in the heart of the Complex Jonquiere in Saguenay, Quebec, the Arvida Aluminium Smelter, AP60 Technology Centre has an installed capacity of 60,000 tonnes of aluminium per year, using the AP60 Technology and is the world's most technologically advanced aluminium smelter. The AP60 technology produces 40 per cent more aluminium per cell than the previous generation of AP Technology™. AP Technology™ enables a step change in productivity by overcoming the challenges of very high amperage smelting technology. AP60 Technology™ is the result of years of continuous and focused efforts in Research & Development and pilot-scale operations. AP60 Technology™ redefines the industry benchmark, providing operators with the world's most advanced and competitive smelter technology. It also reinforces the full economic cost leadership of Rio Tinto Aluminium's AP Technology™ series. Rio Tinto Aluminium's Arvida Research & Development Centre and R&D teams support the smelter and the further development of the AP60 technology platform.

Vaudreuil

Located in Jonquière, Saguenay, Vaudreuil refinery transforms bauxite into alumina via the "Bayer" process. The Vaudreuil site is the largest centre of inorganic chemistry in Canada. The bauxite Vaudreuil uses comes from several countries including Brazil, Guinea and Ghana. It was commissioned in 1936 and is one of the last alumina refineries to operate without being located near a bauxite mine. Vaudreuil refinery produces 1 500 000 tonnes of alumina and specialty products (hydrates, aluminium fluoride) per year. It supplies the majority of Rio Tinto smelter's need in the region, which is converted into primary aluminium in the Saguenay – Lac-Saint-Jean smelters. Vaudreuil is one of the best refinery in the world in terms of greenhouse gases emissions and in terms of energy efficiency.

Link to website: <http://www.riotinto.com/aluminium>

The safety equipment will be provided on site. If the boot sizes can be provided in advance, it would be appreciated. Pregnant women and people with pacemaker cannot visit the plants.

TECHNICAL PAPERS

Aluminium in the Periodic Table¹

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Introduction

In the Periodic Table found in most textbooks of chemistry, aluminum is situated below boron and above gallium (Figure 1). However, its properties are different from both boron and gallium but more similar to the alkali and alkaline earth metals. Moving aluminum to join the other typical metals group with similar properties and electronic configuration will allow dividing the elements into metals, nonmetals, and metalloids (Figure 2). Metals are divided further into typical, less typical, transition, and inner transition. The diagonal similarity between beryllium and aluminum is well marked.

																				H	He				
Li	Be																			B	C	N	O	F	Ne
Na	Mg																			Al	Si	P	Se	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr								
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe								
Cs	Ba	*La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn								
Fr	Ra	**Ac																							

*	Cr	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
**	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lw

Figure 1 - Periodic Table found in most chemistry textbooks

Metals													Nonmetals				H	He							
Transition Metals													Metalloids		Less Typical Metals										
Typical Metals																									
Li	Be																			B	C	N	O	F	Ne
Na	Mg	Al																		Si	P	Se	Cl	Ar	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr								
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe								
Cs	Ba	*La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn								
Fr	Ra	**Ac																							

*	Cr	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
**	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lw

Inner Transition Metals

Figure 2 - A Periodic Table divided in different groups and shows the diagonal similarity

¹ This paper is a supplement to the paper by the author entitled, "Where Aluminum Should Go in the Periodic Table?" published in Proceedings of ICSOBA 2008, Bhubaneswar, India, (No 38) pages 407-414.

Aluminum and boron

Aluminum is a typical metal composed of crystals made of closely packed atoms whose outer electrons are so loosely held that they are free to move throughout the crystal lattice. A typical metal has the following properties:

- An electronic structure similar to that of the inert gases with one, two, or three electrons in the outermost shell.
- A single valency, i.e., it loses its outermost electrons in a single step.
- It is reactive, i.e., reacts readily with water and oxygen. The driving force for this reactivity is the inclination to achieve maximum stability by attaining the electronic structure of an inert gas. A reactive metal such as aluminum or magnesium may be used as material of construction because of the protective oxide film that is formed rapidly on its surface.
- It forms only colorless compounds.

On the other hand boron is a metalloid: in the elemental form its atoms are bonded together by covalent bonds (Figure 3). It has an intermediate properties between metals and nonmetals, i.e., looks like a metal but is fragile like a nonmetal (Figure 4).

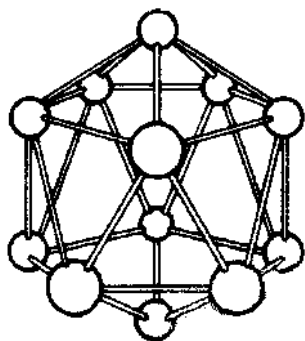


Figure 3 - Structure of elemental boron



Figure 4 - Elemental boron

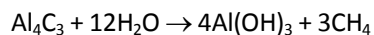
Boron hydroxide, $B(OH)_3$, and aluminum hydroxide, $Al(OH)_3$, are fundamentally different. Boron hydroxide is a weak acid known also as boric acid, H_3BO_3 , which dissolves in alkalis to form borates but is insoluble in acids. Aluminum hydroxide, on the other hand, is an amphoteric hydroxide - - it dissolves in acids and in alkalis. Boron hydride is volatile, flammable, and readily hydrolyzed while aluminum forms solid hydrides.

Aluminum and gallium

Gallium is a less-typical metal, i.e., it differs from a typical metal in that it does not have an electronic structure similar to the inert gases. Its outermost shell contains three electrons and the next inner shell contains 18 instead of 8 electrons as in the inert gas structure. Although gallium occurs in bauxite together with aluminum yet there are marked differences between both metals:

- While aluminum oxidizes so rapidly that it soon forms a non-porous protective layer, gallium does not.
- Gallium can be electrodeposited from aqueous solution, while aluminum cannot.
- $Al(OH)_3$ does not dissolve in ammonium hydroxide solution, but $Ga(OH)_3$ does dissolve.
- Gallium is precipitated from aqueous solution by H_2S as a sulfide; aluminum does not.

- Aluminum forms carbides, gallium does not.
- Aluminum carbide, Al_4C_3 is similar to the carbides of the first three groups, being ionic colorless compound containing the C_2^{2-} anion that decomposes in water. However, it liberates methane instead of acetylene like the other members of the group:



- Gallium forms a gaseous hydride, Ga_2H_6 , while aluminum forms a white solid polymer hydride, $(\text{AlH}_3)_x$.
- Historically, aluminum oxide was considered an earth like the rare earths and it fits with the scandium group.
- Mendeleev successfully predicted the properties of scandium before it was discovered by linking it with aluminum.
- Gallium is a typical dispersed element whose relative abundance in the Earth's crust is $1.5 \times 10^{-3}\%$ while aluminum is the third most abundant element with a relative abundance of 8.13% (after oxygen and silicon).

Aluminum and scandium

The chemistry of scandium is very similar to that of aluminum. Both metals are trivalent and both form colorless compounds. The hydroxides of both metals are amphoteric.

Diagonal similarity

Putting aluminum next to magnesium and above scandium has the advantage of better visualizing the diagonal similarities between Li-Mg, Be-Al, and B-Si (Figure 39):

- Lithium is more similar to magnesium than to the members of the alkali metals. It forms insoluble carbonate like magnesium.
- Beryllium is more similar to aluminum than to alkaline earth metals. It forms covalent bond chloride similar to AlCl_3 .
- Boron is more similar to silicon than to aluminum. It is a metalloid like silicon while aluminum is a typical metal. Boron and silicon hydrides are volatile, flammable, readily hydrolyzed. Aluminum forms solid hydrides. Boron oxide, B_2O_3 , and SiO_2 are similar in acidic nature, can dissolve oxides forming glasses.

SUGGESTED READINGS

- F. Habashi, "A New Look at the Periodic Table," *Interdiscipl. Science Rev.* **22** (1), 53–60 (1997)
- F. Habashi, "Metals: Typical and Less Typical, Transition and Inner Transition," *Foundations of Chemistry* **12** (1), 31–39 (2010)

New Progresses on Utilization of Red Mud in China

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Abstract

The disposal and utilization of bauxite residue is significant in China as it is the biggest alumina producer. The Chinese government and the refineries keep high attention on the commercial utilization of red mud. Nation-wide there were around 10% of red mud utilized as a resource in China at the end of 2015. Some new progresses have been introduced in China on utilization of the red mud in the recent 2 years, such as use of red mud in the soil rehabilitation, in the iron recovery and mineral wool production and in the flue gas desulfurization. The paper provides some references on these developments.

Keywords: Red mud; Iron Recovery; Mineral Wool; Reclamation; Desulfurization.

1. Introduction

Red mud (bauxite residue) is a solid waste generated in the alumina refining from bauxite. It can not be disposed of easily due to its alkali content which can contaminate the environment. Red mud presents a problem as it occupies land and buildings can not be constructed on the abandoned disposal sites nor used the red mud for farming, even if it is dried ^[1]. Therefore a great amount of research and commercial efforts have been made to find methods for the utilization of the red mud.

China is the largest producer of both alumina and red mud in the world. The treatment and utilization of the high volume red mud waste has been a major challenge for the alumina industry. China is paying greater attention on this problem than used to. Several achievements on red mud utilization have been made in China, e.g., storage and reclamation, production of construction materials, preparation of new materials for environment protection, recovery of valuable elements. However, few of these technologies have been applied commercially ^[2]. Nation-wide, there were around 10% of the red mud utilized as a resource in China at the end of 2015, but not 20% as anticipated in 2010 ^[3]. In the recent 2 years, more progresses have been made on the utilization of the red mud in soil rehabilitation, in iron recovery and mineral wool production and in the desulfurization of flue gases.

2. Application in Rehabilitation of Soils Polluted with Heavy Metals

A test was carried out in a paddy field contaminated by Pb, Zn and Cd ^[4]. The results showed that the red mud can significantly decrease the exchangeable metal ions content in soil. It is believed that there are surface active sites at the ferric and aluminate compounds in the red mud, and these surface active sites can fix the heavy metals ions by formation of bonded heavy metals which are difficult to be absorbed by the plants. When alkaline red mud is added to the soil, the pH of the soil can be significantly increased. This is another important mechanism of the red mud to reduce the

mobility of heavy metals and their bio-availability in soils. However, the excessive alkalinity caused by the red mud powder has a negative effect to the growth of paddy. Pretreated red mud pellets can relieve the impact of the red mud on soil alkalinity, as well as improve the capability to stabilize heavy metal ions [5]. A soil conditioner production line with an annual capacity of 20 000 tons has been completed.

The rehabilitation of red mud storage areas is significant for the safe disposal of the red mud. A lab research on-site rehabilitation of a red mud disposal area with red mud of local diasporic bauxite is in operation in Henan province, China. About 77% (50 million tons) of the Chinese alumina capacity are located in the north of China, where the climate is moderate monsoon or moderate continental. Guizhou and Guangxi are located in the subtropical monsoon climate area, which is more suitable for growing plants. Therefore the research carried out in China will be applicable in other places of the World. From the present research, high salinity and poor permeability are the main factors which affect growing of plants with amended red mud.

3. Application in Flue Gas Desulfurization

The high alkali content in the red mud is the critical factor for both the comprehensive utilization and the pollution of the environment. Its high alkali content results in potential pollution of the underground water and soil, the high anti-seepage treatment increase the cost of red mud disposal area, as well as it sets up constraints on usage in the production of cement, tile and road base materials.

When red mud is used in the flue gas (FG) desulfurization the red mud works as desulfurator, instead of other desulfurators like lime, limestone or sodium hydroxide solution. When the red mud slurry is sprayed into the flue gas, the SO₂ in the flue gas reacts with the calcium compounds, the soluble and combined alkali contents of the red mud and harmless calcium sulfate (gypsum) and Na₂SO₄ are generated. The fine particle size and large specific surface area are favourable to achieve a high desulfurization reaction rate. After the desulfurization there is a new gypsum phase in the neutralized red mud, while calcite and certain compounds, e.g. Na₂O·Al₂O₃·xSiO₂·yH₂O, disappear.

The laboratory study and pilot test on the flue gas desulfurization with Bayer red mud were carried out in the authors' company. The pilot test was completed for a boiler with an evaporation capacity of 5 t/h exhausting 15 000 Nm³ flue gas per hour. From the test results, the pH and the Na₂O content of the neutralized red mud was 7.5 and 0.5% respectively, and the SO₂ concentration in flue gas was reduced to below 30 mg/Nm³ from 8 000 mg/Nm³. The 30 mg/Nm³ is below the local SO₂ emission limit. The SO₂ absorption capacity of the red mud varies from 110 to 180 kg-SO₂ per ton of red mud, and depends on the actual composition of the red mud. Following stage, the industrial application in 75 t/h boilers is being planned.

There are 2 key points in FG desulfurization with red mud. The first point is to operate the desulfurization system with the proper process parameters and equipment, in order to obtain high desulfurization efficiency from flue gas and high red mud neutralization yield. The second point is the recovery of the spent sodium sulfate brine for the recycle of water or its harmless discharge.

It is promising to use the red mud for flue gas desulfurization. It can remove the alkali from the red mud with the least cost, as well as reduce the flue gas desulfurization operating cost. The neutralized red mud with low sodium content is easy to be utilized for production of construction materials or for rehabilitation.

4. Iron Recovery and Utilization of the Slag

Recovery of iron from red mud is an important way of using the red mud commercially. Annually, there are about 10 million tons of red mud treated with physical concentration processes, i.e., gravity separation and/or magnetic separation. However, the iron recovery ratio of the physical concentration process is low. Only 800 thousand tons of iron ore could be obtained with a Fe_2O_3 content of 50%-55% by physical concentration.

Using magnetic roasting and reduction smelting technology can improve the recovery rate of iron from the red mud. Two critical problems must be solved before the commercial application of the process. The first one is to reduce the roasting or smelting cost via adopting an advanced smelting technology and equipment, decrease the reduction temperature, and improve the energy utilization rate. The second problem is to increase the benefits via using the residue slag after the recovery of iron.

The traditional iron making processes requires high grade iron ore and coal coke, and also a high amount of energy. A patented coal based direct reduction process with regenerative rotary hearth furnace has been developed [6]. The regenerative furnace has high energy efficiency, and it can be fed with low quality and cheap fuel, which has a calorific value as low as 3 140 kJ/Nm³. More reductive atmosphere and high metal reduction ratio could be obtained based on optimized furnace structure and thermal distribution designs.

Based on this technology, an iron production line from red mud with an annual capacity of 300 thousand tons red mud is under construction. It is expected that the production line can produce 53 thousand tons iron, and 117 thousand tons of mineral wool. In the production line, the pellets, which are made of red mud, coal for reduction and binder are fed into the rotary hearth furnace to maintain reductive roasting atmosphere at high temperature. As there is no relative movement between the thin pellet layers and the furnace lining, it is unnecessary to prepare high strength pellets, and minimum slag scales are formed on the furnace lining. The roasted pellets would be cooled to recover the direct reductive iron (DRI) with magnetic separation, or be transferred into the melting furnace to get cast iron. The slag after the iron recovery is used for the production of building materials and mineral wool.

5. Summary

Chinese alumina refineries continuously work on the exploration of safe disposal of red mud and its utilization to attain the sustainable development. Countless failed attempts tell us that the objective of this work should provide rather the environmental than the economic benefits.

6. References

- [1] Rudraswamy M.P., Prakash K.B.: An experimental investigation on the effect of alternation of alternate wetting and dry on the properties of concrete produced by red mud, *Int. J. Adv. Res.* 2014, 2 (1), 473-484.
- [2] Wanchao L., Jiakuan Y., Xiao B.: Review on treatment and utilization of bauxite residues in China. *Int. J. Min. Proc.* 2009, 93, 220-231.
- [3] Wanchao L. The developing of red mud utilization in China. *Proceedings of the Bauxite residue valorisation and best practices conference BR 2015*, Leuven, Belgium, 5-7 Oct. 2015, 249
- [4] Meirong F., Lin L., Yulin L., Haitao T., Jie T., Bo H.: Effect of red mud on the remediation of Pb, Zn and Cd in heavy metal contaminated paddy soil. *J. Anhui Agri. Sci.*, 2012, 40(6): 3298-3300, 3330
- [5] Xiaojuan W.. Preparation of granular red mud sorbent and the study on its heavy metal adsorption property. Shandong University, master degree thesis, Jinan China, 2013.
- [6] Min W., Mingyuan G., Zhongshan R., Zhicheng C., Xun X.: Technology research on direct reduction of red mud with rotary hearth furnace. *Proceedings of the 6th seminar on tailings and slag utilization*. Quizhou, China, 20-21 Oct. 2015

ICSoba MATTERS

ICSoba Financial Situation

ICSoba fiscal year with Revenue Quebec and Revenue Canada is from 1 January to 31 December. Continuing our dedication to transparency ICSoba finances are audited. Since 2013 a public accountants' office of Gariépy & Bussière CPA INC is requested to carry out the annual task. Summary of operations revenues and expenses for years ending December 31, 2015, 2014 and 2013 is as follows:

	2015	2014	2013
EXPENSES	182 640	238 383	169 669
REVENUES	262 443	228 483	157 493
DEFICIENCY OF REVENUE OVER EXPENSES	79 803	(9 900)	(12 176)
ASSETS CURRENT			
(Cash, GIC, Receivables, Prepaid expenses)	250 789	168 234	178 842
LIABILITIES CURRENT	4 229	1 477	2 185
NET ASSETS	246 560	166 757	176 657

In the 2015 financial audit we read: “Based on the review, nothing indicates that the 2015 Financial Statements are not in accordance with Canadian accounting standards for not-for-profit organization”.

As the Financial Statements reveal the ICSoba monetary reserve has increased by \$79,803 last year, as opposed to losses in previous years (2013, 2014). This was chiefly possible due to better than expected participation from EGA delegates. Also, in Dubai no services were hired to do local organization tasks as most contributions came from local staff (Michel Reverdy - EGA). Although support from sponsors was lower but EGA paid for the gala dinner rather than providing cash sponsorship, and sent a large group of delegates.

Following the financial review the tax declarations were filed with Revenue Quebec and Revenue Canada for 2015.

ICSoba primary revenue leaders are the events and sponsors. As a non-profit, ICSoba focuses on using all resources to advance the association’s mission. The available funds belong to the association and are meant for the development and promotion of ICSoba and future events. Some money reserve is necessary for rainy days and to continue uninterrupted operations and monetary advances.



Dr Frank Feret, CEO, Vice President of ICSoba

Election to the Board of Directors

The most important responsibility that we all have toward the society is to assure ICSOBA continuity. ICSOBA is an international association of members and the members periodically elect the Board of Directors in the Annual Meeting. The next election will take place at the time of the 34th ICSOBA conference to be held in Quebec, Canada (on 5 October in the evening). Among the existing Board members Frank Feret, Andrey Panov and Michel Reverdy have been elected at the last election in Zhengzhou, China for 2 + 2 years. Their first two years of the mandate will come to the end at the time of the conference in Quebec. They may stay if they wish to continue for another two years. Four other directors on the present Board were nominated, so they will be asked to step down. Three may seek re-election and the fourth (President) will be nominated according to current Bylaws.

During the election we need to make sure that we have the hands to pass the torch to so it can be carried into the future. Appropriate board composition is important not only for the operation of the entire team, but for individual well-being of each of the members. Group of directors ought to be filled with members, whose mutual interaction has a beneficial and positive nature. The elected individuals ought to be strongly identified with the aluminium industry and be committed to maintaining its credibility and accountability on the international scale. The renewed board would be expected to forge a strong bond and trust with present members and push ICSOBA's legacy to the next level.

Scientific Citation

Modern scientists are sometimes judged by the number of times their work is cited by others—this is actually a key indicator of the relative importance of a work in science. Accordingly, individual scientists are motivated to have their own work cited early and often and as widely as possible. Especially students and young scientists are motivated to get this mean of judgement. A formal citation index tracks which referred and reviewed papers have referred which other such papers. Many consider the number of times a paper is cited to be a significant metric of its quality, and thus of innovation.

In 1964, a journal called TRAVAUX was organized for publishing lectures from ICSOBA events and other information of common interest. Until 2015 TRAVAUX was issued in 44 volumes. All past volumes appear as printed books except for the last volumes starting from 2005, which were also available in electronic format. Until present, the TRAVAUX volumes have only been available to the members and conference delegates and have not been indexed in any of the most popular science and technology search engines worldwide. The tables of content are at the ICSOBA website (www.icsoba.org) as searchable pdf files. There is full list of papers available of all volumes on the website which can be used as a guide for finding specific information or paper. However, to access this information someone needs to enter the ICSOBA website.

At present, ICSOBA would like to open access to the articles and assure citations (indexing). The Internet search should allow tracing down a specific subject, article title or an author's name. The full article would only be available upon a direct request. The process would begin with the last year proceedings (34th ICSOBA conference in Dubai, UAE; Volume No 44). The established mechanism should allow further additions of content from future or past volumes.

Detailed Information (Monograph) on Laterite and Bauxite of Madhya Pradesh, India

Dr Rakesh Shrivastava and Dr Suyash Kumar, both professors at the Department of Geology, Government Model Science College, Gwalior, MP, India, intend to publish a monograph on laterite and bauxite of Madhya Pradesh. This project will certainly require the help of institutions and industries in India related to bauxite and alumina for collection of data. Dr Shrivastava and Kumar took up this task with full devotion along with their regular teaching and research. ICSOBA will provide an information platform on progress of the monograph and will partially sponsor participation of one of the authors in the Quebec event this year. A preliminary structure/content of the monograph is given below.

Authorship: Rakesh Shrivastava¹ and Suyash Kumar²

1. Professor 2. Assistant Professor

Department of Geology, Government Model Science College, Gwalior, MP, India-474009

Corresponding author: rakesh_geol@yahoo.co.in

Proposed content of the monograph

1. Laterites and Bauxites, their origin
2. Laterites and bauxites of India
3. Geology of Madhya Pradesh
4. Geomorphology, tectonism and structure
5. Development of laterite profile
6. Laterite and bauxite occurrences in Madhya Pradesh.
7. Petrographic and Mineralogical characteristics
8. Geochemical characteristics
9. Mining and environmental impact
10. Techno-economic evaluation, uses and specification of laterite and bauxite.
11. Ochre and clay mining
12. New scope of studies on laterite and bauxite of Madhya Pradesh

Public Relations and Communication

Membership

ICSOBA is an international association of members. ICSOBA belongs to its members and since the members elect the Presidency and Council in the Annual Meeting during an ICSOBA Event, members determine the policy and success of ICSOBA.

Members are provided 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. Digital versions of past proceedings are available at no cost for members.

Companies can support ICSoba by becoming corporate member. Corporate members are shown in all Newsletters and listed on the 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)	US\$ 100	US\$ 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.

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.org/proceedings>. ICSoba members can obtain digital versions up to 20 papers each year at no cost by sending an email request to Dipa dipa.chaudri@icsoba.org or info@icsoba.org. Additional papers are charged for CA\$ 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 info@icsoba.org 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.org/corporate-members>

AMBER DEVELOPMENT	www.amber-development.com
BOKELA GmbH	www.bokela.com
BRUKER AXS	www.bruker.com
CETCO	www.cetco.com
CYTEC Industries Inc.	www.cytec.com
FELUWA Pumpen GmbH.	www.feluwa.com
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HATCH	www.hatch.ca
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RIO TINTO	www.riotinto.com
SEFAR BDH Inc.	www.sefar.com
Shandong Jingjin Filter Press	www.dmxs-com@263.net
SNF	www.snfhc.com
STC Engineering GmbH	www.stc-engineering.de
Weir Minerals Netherland b.v.	www.weirminerals.com

A series of books

A list of books of Prof. Fathi Habashi on metallurgy, hydrometallurgy and related subjects is enclosed and highly recommended to review since these books comprise a mine of information for those who look for facts and inspiration.



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A non-profit publisher devoted to the diffusion of extractive metallurgy literature.

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President

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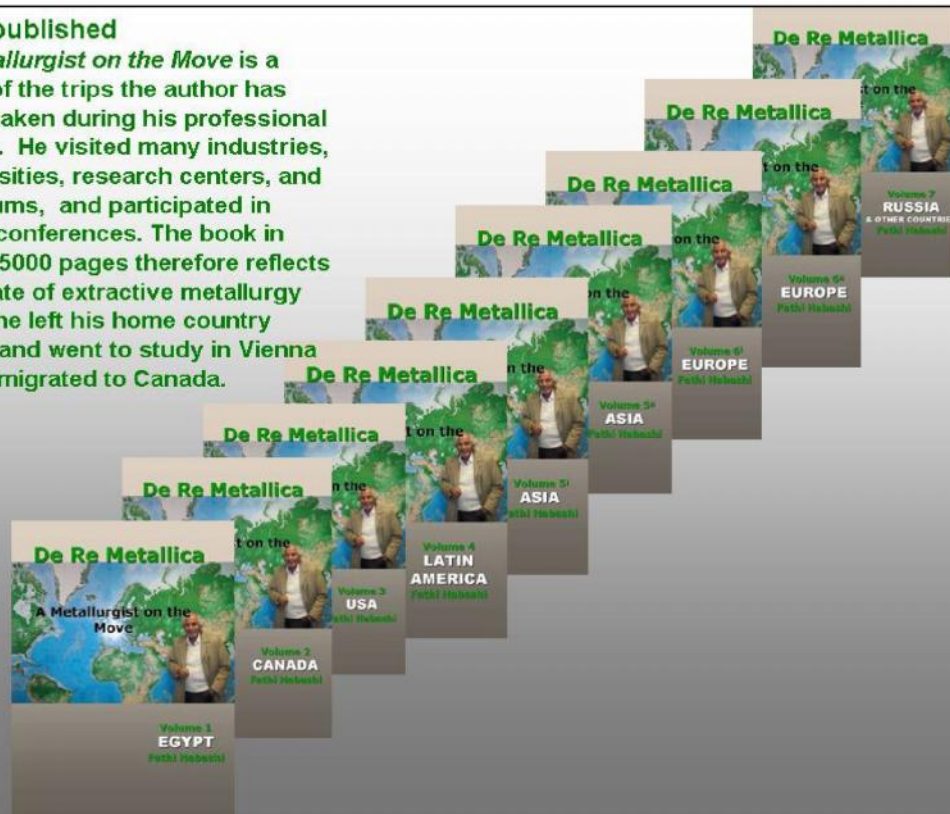
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Just published

A Metallurgist on the Move is a diary of the trips the author has undertaken during his professional career. He visited many industries, universities, research centers, and museums, and participated in many conferences. The book in about 5000 pages therefore reflects the state of extractive metallurgy since he left his home country Egypt and went to study in Vienna then emigrated to Canada.




ISBN 978-2-922686-21-0, \$ 1500 + postage

	<p>Volume 1- Egypt, published in 2014, 590 pages includes Preface in 75 pages. Part 1: Historical introduction, 210 pages</p> <p>Part 2: Living in Egypt, 210 pages</p> <p>Part 3: Visits to Egypt and the Future of Egypt, 51 pages</p>		<p>Volume 2- Canada, published in 2014, 498 pages, includes a historical introduction in 42 pages</p>	
	<p>Volume 3- USA, published in 2014, 315 pages, includes a historical introduction in 32 pages</p>		<p>Volume 4- Latin America, published in 2014, 680 pages, includes a historical introduction in 24 pages</p>	
	<p>Volume 5 - Asia: Part 1- Afghanistan to Indonesia, 600 pages, published 2015.</p>		<p>Volume 5 - Asia: Part 2- Iran to Vietnam, 577 pages + indexes, published 2015.</p>	
	<p>Volume 6 - Europe: Part 1- Albania to Germany, 844 pages, published in 2015.</p>		<p>Volume 6 - Europe: Part 2- Gibraltar to Vatican, 789 pages + indexes, published in 2015</p>	
	<p>Volume 7 - Russia and Other Countries, published 2015, xxx pages, includes appendices: 1- Interviews, 2- Books by the author, 3- Publications by the author</p>			
	<p>Metallurgic Chymistry. A facsimile English edition of Gellert's Metallurgic Chymistry. First published in German in 1751, with an introduction by Fathi Habashi. ISBN 2-980-3247-3-6, 500 pages. 1998. Can \$ 60 + postage</p>			<p>Schools of Mines. The Beginnings of Mining and Metallurgical Education by Fathi Habashi. More than 600 pages illustrated with 350 figures and maps of which 73 are in color, includes the history of 92 schools, over 400 biographies, over 100 selected references and 27 pages of indexes. Published 2003. Can \$ 80 + postage</p>
	<p>From Alchemy to Atomic Bombs by Fathi Habashi. The book is in 365 pages with 220 illustrations, 30 of them in color. ISBN 2-922-686-00-0. Published 2002. Can \$ 70 + postage</p>			<p>Chemistry and Metallurgy in the Great Empires by Fathi Habashi. The book in 272 pages, 21.5 x 28 cm, hard cover, fully illustrated in colour, is suitable for the general reader as well as metallurgical engineers, chemists, and students. ISBN 978-2-922686-03-6. Published 2009. \$ 70 +postage</p>
	<p>A History of Metallurgy A collection of articles on the history of extractive metallurgy originally published in <i>History of Technology</i> between 1954 and 1958 and edited by Fathi Habashi. 330 pages, 123 Figures. ISBN 2-980-3247-1-X. Can \$ 35 + postage</p>			<p>The Story of Metals. Discovery, Recovery, and Uses, two volumes by Fathi Habashi, 1061 pages, 15 x 23 cm, soft cover. Metals are not arranged according the Periodic Table or alphabetically but are arranged according to their discovery. There are two introductory chapters on metals and their history. The book is illustrated by many Figures mostly in color, biographies of many chemists and metallurgists, and many flowsheets of processes. ISBN 2-922686-01-9, \$ 90. 2015. Available only in electronic form.</p>
	<p>Readings in Historical Metallurgy. Volume 1 by Fathi Habashi. The book is in 775 pages, illustrated by 490 Figures many of them in color, contains over 165 biographical notes of the scientists and engineers who contributed to this endeavour. ISBN 2-922686-02-7.</p>			<p>Mining and Metallurgy on Postage Stamps by: Fathi Habashi, David Hendricker, and Claude Gignac. ISBN 2-980-3247-4-4, 320 pages, Published 1999. Can \$ 200 + postage</p>

	<p>Published March 2006. Can \$ 95 + postage</p>		<p>Extractive Metallurgy Today: Progress and Problems by Fathi Habashi. 325 pages illustrated by 162 pictures of which 75 are in color. Published April 2000. ISBN: 2-9803247-8-7. Can \$ 40 + postage</p>
	<p>Researches on Copper. History & Metallurgy by Fathi Habashi. The present volume is a collection of selected papers dealing with the extractive metallurgy of copper published by the author and his coworkers plus ten new chapters specially written. The book is fully illustrated by many coloured pictures, flowsheets, and diagrams - - should be useful for students, engineers, chemists, geologists, and for research workers. ISBN 2-922686-14-2, 410 pages 8½" x 11". Published in 2009. \$ 50 + postage</p>		<p>Extractive Metallurgy of Copper, by Fathi Habashi. ISBN 978-2-922686-19-7, 415 pages 6" x 9" . Published in 2012. The book included the chemistry of copper, its history, ores, beneficiation, pyrometallurgy, hydrometallurgy, electrometallurgy, and kinetics of leaching copper minerals. \$ 40 + postage</p>
	<p>Gold. History, Metallurgy, Culture by Fathi Habashi. ISBN 978-2-922686-13-5, 277 pages 8½" x 11". Published in 2009. This collection of articles gives a rapid and fully illustrated review of the history and extractive metallurgy of gold. \$ 60 + postage</p>		<p>Science, Technology, and Society by Fathi Habashi. this vast and complex question is discussed from five points:</p> <ol style="list-style-type: none"> 1. Social responsibility of scientists 2. Migration and movement of scholars 3. Philanthropy and its role in education and culture 4. Enlightened despots and their influence on science and culture 5. Social aspects of mining <p>The book is meant for the general reader but can benefit scientists as well. Pictures have an important role to convey a message and for this reason some time was spent in selecting them from a variety of sources. 316 pages, fully illustrated mostly in colour. ISBN 978-2-922686-01-2. Published 2009. \$ 30 + postage</p>
	<p>Ida Noddack (1896-1978). Personal Recollections by Fathi Habashi. The book is illustrated with numerous photographs, many of them in colour and contains facsimile of 12 letters and 4 historical papers by Ida Noddack. ISBN 2-922686-08-6. Published February 2005. Can \$35 +postage</p>		<p>70 Years Old. Department of Mining, Metallurgical, and Materials Engineering, Université Laval, 1938–2008 by Fathi Habashi. ISBN 978-2-922686-11-1. Down load free of charge at http://works.bepress.com/fathi_habashi/ \$ 15 + postage</p>
	<p>The Copts of Egypt. The history of the Copts is briefly told by Fathi Habashi in 92 pages, fully illustrated by coloured pictures. Published 2006, ISBN 2-922686-09-4. Can \$ 10 + postage</p>		<p>Aqua Science Through the Ages. An Illustrated History of Water by Fathi Habashi. Published 2009. ISBN 978-2-922686-06-7, 166 pages fully illustrated by coloured pictures, Can \$ 35 + postage</p>
	<p>Mining and Civilization. An Illustrated History by Fathi Habashi. Published 2010. ISBN 978-2-922686-16-6. Fully illustrated in color, 510 pages, published August 2010, covers history of mining and quarrying in relation to world civilization. Can \$ 80 + postage</p>		<p>Metallurgical Chemistry by Fathi Habashi. An audio course for students and engineers in 5 hours, published by the American Chemical Society, composed of a 265 page reference manual and a CD. Can \$ 95 + postage</p>

	<p>Metals from Ores: An Introduction to Extractive Metallurgy by Fathi Habashi. In 475 pages incorporating 215 illustrations (50 in color) and numerous Tables. ISBN 2-922686-04-3. Published August 2003. Can \$ 40 + postage</p>		<p>Textbook of Pyrometallurgy by Fathi Habashi. 615 pages. ISBN 2-922686-05-1. Published August 2002.615 pages. Can \$ 40 +postage.</p>
	<p>Textbook of Hydrometallurgy, by Fathi Habashi. The book covers the general principles of solution chemistry, engineering aspects, and detailed studies of hydrometallurgical processes in 700 pages fully illustrated with drawings and photographs. ISBN 2-980-3247-0-1. 1999. Out of print</p>		<p>Textbook of Hydrometallurgy, 2nd edition by Fathi Habashi. The book covers the general principles of solution chemistry, engineering aspects, and detailed studies of hydrometallurgical processes in 750 pages fully illustrated with drawings and photographs. ISBN 2-980-3247-7-9. 1999. Can \$40 + postage.</p>
	<p>Principles of Extractive Metallurgy, volume 1 - General Principles, by Fathi Habashi, published by Gordon& Breach Science Publishers, New York 1969. Out of print</p>		<p>Principles of Extractive Metallurgy, volume 2 - Hydrometallurgy, by Fathi Habashi, published by Gordon& Breach Science Publishers, New York 1970. Out of print</p>
	<p>Principles of Extractive Metallurgy, volume 3 - Pyrometallurgy, by Fathi Habashi, published by Gordon& Breach Science Publishers, New York 1987. Out of print</p>		<p>Principles of Extractive Metallurgy, vol. 4 - Amalgam & Electrometallurgy by Fathi Habashi. 380 pages. ISBN 2-980 980-32473247-5-2. Published 1998. Can \$ 80 + postage</p>
	<p>Kinetics of Metallurgical Processes by Fathi Habashi. The book covers the general principles of heterogeneous non-catalyzed reactions which are the basis of extractive metallurgy. ISBN: 2-980-3247-6-0, 376 pages. September 1999. Can \$40 + postage</p>		<p>Pollution Problems in the Mineral and Metallurgical Industries by Fathi Habashi. ISBN 2-980- 3247-2-8, published 1996. 147 pages. The book outlines the problems faced in the industry and how they were solved. \$ 25 + postage</p>
	<p>Mineral Processing for Nano-Scientists, by Fathi Habashi, ISBN 978-2-922686-18-0. Published August 2011. The book explains what is a metal, a nonmetal, and a metalloid, and summarises the processes is use for extracting metals from their ores. \$ 20 + Postage</p>		<p>Alloys: Preparation, Properties, Application edited by Fathi Habashi. 314 pages, ISBN 3-527-29591-7. Published 1998 by WILEY-VCH. Now available from Métallurgie Extractive Québec. Can \$ 30 + postage</p>
	<p>Aluminum. History & Metallurgy by Fathi Habashi. 160 pages, ISBN 2-922686-12-4. Published 2008, is a collection of some papers published by the author during the period 1993–2008. They include: The Pioneers, Metallurgy, and Selected Topics. The collection gives a rapid and fully illustrated review of the history and extractive metallurgy of aluminum. \$ 40 + postage</p>		<p>Researches on Rare Earths. History & Technology by Fathi Habashi. A selected collection of papers by the author and his co-workers to which an outline on the recovery of rare earths from different sources has been specially written. The position of rare earths in the Periodic Table is also discussed. ISBN 978-2-922686-15-9, published 2008, 125 pages, fully illustrated, \$25 + postage</p>

	<p>The Future of Extractive Metallurgy by Fathi Habashi. Published by CETEM in Rio de Janeiro, Brazil.</p>		<p>Chalcopyrite. Its Chemistry and Metallurgy by Fathi Habashi, 177 pages. ISBN 0-07-025-383-8. McGraw-Hill International Book Company, 1978. Now available for \$ 40 + postage from Métallurgie Extractive Québec</p>
	<p>Pyrite. History, Chemistry, and Metallurgy by Fathi Habashi, 115 pages. ISBN 978-2-922686-20-3. \$20 + postage</p>		<p>Researches on Asbestos, by Fathi Habashi, ISBN 978-2-922686-17-3, 110 pages. Published 2011. The book contains articles on the history and structure of asbestos, surface modification of its surface by organic dyes, and the toxicity issue. \$ 20 + postage</p>
	<p>Chemical Technology of Ore Processing by Vladco Panayotov, Fathi Habashi, and Marinela Panayotova in 218 pages, 20.5 x 28.5 cm, hard cover, is a combined effort of authors from different countries with different background. Published 2015 by St. Ivan Rilski Publishing House, University of Mining & Geology, Prof. Boyan Kamenov Street, Sofia 1700, Bulgaria. ISBN 978-954-353-259-9.</p>		<p>The Recovery of Elemental Sulfur from Sulfide Ores by Fathi Habashi. Bulletin No. 51 Montana Bureau of Mines and Geology, Butte, Montana (1966). Now available for \$ 10 + postage from Métallurgie Extractive Québec</p>
	<p>Kinetics and Mechanisms of Gold and Silver Dissolution in Cyanide Solution by Fathi Habashi. Montana Bureau of Mines & Geology, Butte, Montana, <i>Bulletin</i> 59 (1967). Now available for \$ 10 + postage from Métallurgie Extractive Québec</p>		<p>Uranium in Phosphate Rock. Montana Bureau of Mines & Geology, Butte, Montana, Special Publication 52 (1970). Contains translation from German of a paper, "Mechanism of Extraction of Uranium from Phosphate Rock", and other papers by Fathi Habashi. Now available for \$ 10 + postage from Métallurgie Extractive Québec</p>
	<p>International Symposium. Problems of Complex Ores Utilization, edited by Fathi Habashi, Ilya N. Beloglazov, and Arnold A Galnbek. Published by Gordon & Breach. Now available from Métallurgie Extractive Québec for \$40 + Postage</p>		<p>PROCEEDINGS 9th International Symposium Cultural Heritage Geosciences, Archaeology, Mining, and Metallurgy. Quebec City September 2 - 7, 2007. Edited by Réginald Auger, Laurier Turgeon, and Fathi Habashi. ISBN 978-2-923663-02-9. Published by Centre d'étude sur les lettres, les arts, et les traditions [CELAT], Université Laval. Available for \$ 10 + postage from Métallurgie Extractive Québec</p>
	<p>Progress in Extractive Metallurgy. Volume 1, edited by Fathi Habashi. Published by Gordon & Breach, New York 1973, 239 pages. Now available from Métallurgie Extractive Québec for \$ 40.</p>		<p>Mineral Resources of the Arab Countries by Fathi Habashi and Fouad Bassyouni. Chemecon Publishing Limited, London, 1982. First edition published by Faculté des sciences sociales, Université Laval 1979, 100 pages. Now available from Métallurgie Extractive Québec \$ 50 + shipping</p>
	<p>Periodic Table of the Elements 24x36 inches Poster includes atomic weights, atomic numbers, atomic volume, electronic configuration, lanthanide contraction, density, melting points, diagonal similarities, Table showing metals, nonmetals, and metalloids, and Mendeleev. \$ 50 + shipping</p>		<p>T-shirt Periodic Table. Small, medium, large, \$ 25</p>
<p style="text-align: center;">Available from WILEY- VCH Weinheim, Germany Handbook of Extractive Metallurgy, edited by Fathi Habashi, Published 1997, 2379 pages, ISBN 3-527-28792-2</p>			

	<p>Volume 1, 491 pages</p> <ul style="list-style-type: none"> - The Metals Industry - The Economic - Classification of Metals - Metals Production - Recycling of Metals - Ferrous Metals: Iron, Steel, Ferroalloys 		<p>Volume 2, 692 pages</p> <ul style="list-style-type: none"> - Primary Metals: Copper, Lead, Zinc, Tin, Nickel - Secondary Metals: Arsenic, Antimony, Bismuth, Cadmium, Mercury - Cobalt Light Metals: Beryllium, Magnesium, Aluminum, Titanium
	<p>Volume 3, 578 pages</p> <ul style="list-style-type: none"> - Precious Metals: Gold, Silver, Platinum Group Metals - Refractory Metals: Tungsten, Molybdenum, Niobium, Tantalum, Zirconium, Hafnium, Vanadium, Rhenium - Scattered Metals: Germanium, Gallium, Indium, Thallium, Selenium, Tellurium - Radioactive Metals: General, Uranium, Thorium, Plutonium - Rare Earth Metals: General, Cerium 		<p>Volume 4, 665 pages</p> <ul style="list-style-type: none"> - Ferroalloy Metals: Chromium, Manganese, Silicon, Boron - Alkali Metals: Lithium, Sodium, Potassium, Rubidium, Cesium, Alkali Sulphur Compounds - Alkaline Earth Metals: Calcium, Strontium, Barium

TRANSLATIONS

	<p>Principles of Extractive Metallurgy, Volume 1 — General Principles by Fathi Habashi (Chinese translation) <i>Ti Qu Yie Jin Yuan Li</i>, volume 1 (252 pages). Ministry of Metallurgy, Beijing, China 1974–1978.</p>		<p>Principles of Extractive Metallurgy, Volume 2 — Hydrometallurgy by Fathi Habashi (Chinese translation) <i>Ti Qu Yie Jin Yuan Li</i>, volume 2 (307 pages). Ministry of Metallurgy, Beijing, China 1974–1978.</p>
	<p>Principles of Extractive Metallurgy, Volume 1 — General Principles by Fathi Habashi (Russian translation) <i>Основы Прикладной Металлургии</i>, volume 1 (232 pages). Металлургия, Moscow, Russia 1975.</p>		<p>Principles of Extractive Metallurgy, Volume 2 — Hydrometallurgy by Fathi Habashi (Russian translation) <i>Основы Прикладной Металлургии</i>, volume 2 (392 pages). Металлургия, Moscow, Russia 1975.</p>
	<p>Principles of Extractive Metallurgy, Volume 2 — Hydrometallurgy by Fathi Habashi (Vietnamese translation) <i>Nguyên Lý Các Quá Trình Luyện Kim Từ Quặng</i>, volume 2 — Thủy Luyện (272 pages), Nhà xuất bản khoa học và kỹ thuật, Hanoi, Vietnam 1977.</p>		<p>Pollution Problems in the Mineral and Metallurgical Industries by Fathi Habashi (Vietnamese translation) <i>Vấn đề ô nhiễm trong công nghiệp mỏ và luyện kim</i> (120 pages), Nhà xuất bản Giáo dục, Hanoi, Vietnam 2005.</p>
	<p>Pollution Problems in the Mineral and Metallurgical Industries by Fathi Habashi (Farsi translation)</p>		<p>Textbook of Hydrometallurgy by Fathi Habashi (Farsi translation in two parts) «<i>دیپلوماالوژر</i>» (volume 1: 364 pages, ISBN 964-9272-2-9; volume 2: 336 pages, ISBN 964-7637-00-4), Shahrood University of Technology Press, Tehran, Iran 2000.</p>
	<p>Kinetics of Metallurgical Processes by Fathi Habashi, Farsi translation</p>		<p>Metals from Ores. An Introduction to Extractive Metallurgy by Fathi Habashi (Arabic translation: علي من م - مقدمه) Published in 2011 by Al-Hussein Bin Talal University, P.O. Box 20, Ma'an, Jordan 71111. 514 pages, ISBN 2010-8-2891</p>