21st Century Technology Support for Non-Ferrous Metals Corporations – Bricks and Mortar or Virtual?

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Despite very large and often very adverse price cycles for their products, in the last half of the 20th Century the global non-ferrous metals industry rose to meet the challenges. Markets have expanded dramatically on a global basis and the industry now makes higher quality metals at lower (constant) dollar costs in plants which meet much more stringent environmental regulations.

To survive and make these remarkable advances, the non-ferrous metals industry had to implement major technological changes. Paradoxically, as the industry benefitted greatly from technology so the ability of corporations to develop new technology internally in the same time period declined precipitously. There is now a serious concern that the industry will not have adequate capability of meeting upcoming technological demands.

This paper first presents a review of corporate technology support, primarily in North America, in the non-ferrous metals industry in the past 50 years. The contributions of individual technology centres in the “golden age” following World War II are noted as well as the reasons for the elimination of many corporate centres from 1980 onwards. The challenge facing the industry in the 21st century is to learn from the lessons of the past so that individual corporations can identify suitable technological development mechanisms for future growth and prosperity.

In looking forward, three general models for technology support have been identified and are known to be in operation. They are essentially linked to the size and global needs of the companies. Particularly, the paper evaluates the benefits of companies retaining in-house (bricks and mortar) capabilities or moving to (virtual) organizational structures which will develop all technology externally.

Finally, the paper discusses the ongoing need for maintaining critical levels of expertise within the industry. Future success in metallurgical technology will largely depend on the availability of internal consultants, global external centres of excellence and metallurgical testing facilities for identifying opportunities which can then be linked to engineering partners for commercial realisation.

Keywords:
- Non-ferrous metals industry – Consolidation and globalisation – Technology centres – Levels of corporate activity – Virtual technology support

Technologische Unterstützung für NE-Metallproduzenten im 21. Jahrhundert – in Eigenregie oder extern?

Assistance technique au compagnies de l’industrie des métaux non-ferreux au 21ème siècle – par l’entreprise ou à l’extérieur?

Soporte tecnológico en el siglo XXI para empresas de metalurgia no ferrosa – virtual o no virtual?


1 Introduction

The companies which comprise the Non-Ferrous Metals Industry (NFMI) today have essentially been around in some semblance of their current organisations for just over 100 years. The author is coming to the end of a career almost wholly devoted to technology support in the NFMI, so it could be said that he has witnessed the “evolution” of technology support in North America for about one third of this time span.

Since the intent of this paper is to look into the future as the industry undergoes further consolidation, it is considered that the best place to start is to quickly review the pattern of events in relation to technology support, particularly in North America during the latter half of the 20th century, so that the industry can avoid the trap laid out in the famous saying of SANTAYANA [1] – “Those who do not learn from the past are condemned to repeat it.”

Intriguingly, the traditional role of the NFMI in supplying the “building blocks of civilization” [2] has, in the last few years, become highly visible to the Western public. There is an awareness, for the first time, of the huge need for metals in China and other Asian countries. These economies are being built on copper for electricity and communications, aluminium for construction and transportation, nickel for stainless steel, zinc for corrosion protection and lead for automotive batteries.
The Non-Ferrous Metals Industry and Social Sustainability in Japan

Toshiharu Fujisawa

The paper describes the developments and achievements of the non-ferrous metals industry of Japan in the recycling of non-ferrous metals and the solid waste processing. The expansion of the activities of the Japanese non-ferrous metals industry towards the environmental business is outlined and the contribution to achieve social sustainability in Japan is highlighted.

Keywords:

1 Introduction

Environmental issues are growing to be a major social argument and the realization of the resource-recycling society is desired. In Fiscal Year (FY) 2001, about 2059 million tons of resources were used in Japan [1]. Among them, secondary resources are about 280 mill t and correspond to 13.6% of the above. This ratio increased steadily from 7.8% (FY 1995) by the development of various recycling technologies and great effort. How much can we increase this ratio?

On the other hand, about 52 mill t of waste, 42 mill t of industrial waste and 10 mill t of non-industrial waste are landfilled. The remaining life of final disposal (= remaining final disposal capacity/annual final disposal quantity) is relatively short, estimated to be four years for industrial waste and twelve years for non-industrial waste. It is difficult to acquire the agreement of local residents for the construction of new landfill sites, because of the concerns about the landfill sites themselves and the safety of the waste disposed in them. Thus, construction of new landfill site is hard to be expected, and reclamation projects for existing landfill sites are seriously considered.

Unlike organic materials, which change or disappear by reactions, metallic materials are recyclable without any losses of the physical or chemical properties and are essentially renewable and immortal resources. Among various circulation paths of materials, reuse and recycling, the recycling path from waste to raw materials finally closes the loop of the material circulation. Thus, the metal production industry, of course including non-ferrous metals industry, should play an important role. Recycling of base metals, such as copper, lead and zinc, must be an important duty for non-ferrous metals industry.

2 Recycling of base metals

From the recycling viewpoint, metallic materials can be divided into two groups (Figure 1). Base metals, such as Fe, Al, Cu, produced in large amount, and precious metals, such as Au, Ag, and Pt, are relatively easy to recover. Rare metals, used in a variety of applications and distributed in very high dilution, and Zn, used mainly for corrosion protection, are relatively difficult to recover.

In Japan, about 36% of iron production comes from recycled iron (recycling ratio: rd. 36% of annual production), while the recycling ratio of aluminum is rd. 30% of annual consumption (almost no aluminum production in Japan), the recycling ratio of copper amounts to rd. 19% of annual production (rd. 60% of disposed quantity), the recycling
Restructuring of the Non-Ferrous Metals Industry in Poland

Zbigniew Smieszek

The paper presents the state of technology and forms of proprietorship and organisation of the non-ferrous metals industry. The basic scope of technological modernisation of the Polish non-ferrous metals industry in the last 15 years is described. The technological modernisation mainly covered the basic systems, such as: intensification of production to achieve cost reduction, modernisation of technology to increase product quality and to widen the production assortment to rise the saleability of the products. The basic projects conducted from the beginning of the nineties for environmental protection are described, together with a general evaluation of the non-ferrous metals industry influence on the environment. Perspectives for operations and plans for technological development in the non-ferrous metals industry in Poland with respect to copper, zinc and lead and aluminium production are presented, also including plans related to the development of non-ferrous metals processing and production of final products.

Keywords:
Restructuring – New technologies – Environmental protection

Die Umstrukturierung der NE-Metallindustrie in Polen


Schlüsselwörter:
Umstrukturierung – Neue Technologien – Umweltschutz

Restructuration de l’industrie des métaux non-ferreux en Pologne

Reestructuración de la industria de metales no ferrosos en Polonia


1 State of technology and forms of proprietorship and organisation of the non-ferrous metals industry before the economical transformation

The non-ferrous metals industry is one of the well developed branches of the Polish economy, able to yield profits under normal economical conditions. The industry has applied market economy mechanisms for many years already, being always profitable, and has never asked for help from any national public funds. The structure of the Polish non-ferrous metals industry presents a complex system, beginning with mining, through ore beneficiation, metallurgy to various processing technologies. That structure is composed of three basic technological groups, which define processes of semi-product and final product manufacture:

- Mining, metallurgy and processing of copper
- Mining, metallurgy and processing of zinc and lead
- Metallurgy and processing of aluminium

The non-ferrous metal companies had and still have access to both copper, zinc and lead ores and scrap. The non-ferrous metals industry imports relatively low volumes of basic raw materials, mainly aluminium oxide for the production of aluminium and some blende concentrates for zinc production (about 110,000 Mg per year of each of those products).
In spite of the numerous advantages of induction melting technology the energy expenditure for the melting and pouring of copper materials is an essential economical factor, the more so at times of rising energy prices. Based on the factors influencing power consumption, several ways of saving energy are explained and substantiated by actual figures. The potential savings to be achieved are in the order of 20%.

Keywords:
Copper materials – Induction furnace – Energy savings – Influencing factors – Examples and recommendations

Energiesparendes Schmelzen von Kupferwerkstoffen in modernen Induktionsöfen

Schlüsselworte:
Kupferwerkstoffe – Induktionsöfen – Energieeinsparung – Einflussgrößen – Beispiele und Empfehlungen

Economies d'énergie grâce à la fusion de matériaux cuivreux dans des fours à induction modernes
Ahorro de energía en la fusión de materiales de cobre en hornos modernos de inducción
Paper presented on the occasion of the GDMB Experts Committee on Copper, April 14 to 15, in Hamburg.

1 Introduction
The technical and economical benefits of induction technology have led to its ever increasing application in melting and pouring of copper materials (Figure 1). However, it is only with the choice of the right type of equipment, its optimum design and proper mode of operation that the benefits of this technology can be utilised to the full. This applies in particular to the energy consumption: If certain rules are observed, consumption can be reduced by up to 20%. This is gaining increasing significance in cost cutting, the more so at times of rising energy prices.

2 Key factors
The key factors influencing power consumption for melting to given specifications include in particular:
• type of furnace
• furnace design, rating and dimensioning
• mode of operation
• production management.

Energy saving efforts are therefore focused in two directions: Firstly, in the technical planning and design stage, the electrical and thermal losses of the equipment must be reduced and the best suitable equipment configuration selected. Secondly, in using the furnaces, any additional energy requirements due to improper mode of operation must be avoided.

2.1 Furnace type – channel or coreless
The use of the induction principle for melting of metals entails electrical and thermal losses of the furnace, the amounts of which depend on the metal to be melted and
Copper has been in use by mankind for eight to nine thousand years but it was very recently only that it acquired its reputation for being toxic for human health and the environment. This happened after individuals attempted to commit suicide with copper sulfate in the 19th century. In 1912, a disorder of the human nervous system associated with liver cirrhosis and excess copper was described by S.A.K. Wilson and it was later shown to be due to a defective recessive gene responsible for excretion through the bile. Copper toxicity in animals also began to be studied systematically in the first half of the 20th century. It was not until the end of the 1980’s, nevertheless, that copper was included – for the first time at global level – in a list of toxic substances. This occurred in the Basel Convention for Transboundary Movements of Hazardous Wastes. And then came an avalanche. In 1991, the U.S. Environmental Protection Agency, USEPA, created the lead and copper rule which regulated copper in drinking water due to its potential gastrointestinal effects. That same year, the World Health Organization, WHO, decided to include copper in its list of chemicals of health significance in drinking water, due to its potential chronic liver effects. The copper industry, even though it took two years – until the guideline value of the WHO was published in 1993 – in realizing this momentous change, understood that this was a turning point in the long history of the metal. It was necessary to solve these issues but it was clear that in order to have capacity to negotiate with any of these organizations, it was necessary to have sound scientific knowledge. And since the industry did not have it, it was not even able to sit at the same table with these regulatory agencies. Fifteen years after these events, much progress has been made in the understanding of these issues, but we are still far from being able to answer all the questions, and I would say, even the most relevant questions. Some of the original concepts posed by the WHO and the Basel Convention were proved to be wrong but new issues emerged with the progress of science. Indeed, the scientific challenge is far greater at present than it was 15 years ago due to the complexity of the science involved, and also the regulatory pressure at present is not based only in the developed world as it was then.

This paper discusses the main changes occurred in this brief time period regarding the health and environmental regulatory status of copper and the main trends understood at present, as well as its potential impacts on copper markets.

Keywords:
Copper toxicity – Water-solubility – WHO – Biotic Ligand Model BLM – Plumbing tubes – Environmental image

1 Introduction
Are environmental and human health considerations of relevance for copper markets?
No one would deny this. Companies lose value in the stock exchanges when they are involved in environmental events, they choose the materials with which they manufacture their products taking into account environmental considerations, governments penalize companies that do not comply with environmental laws, environmental product labels are already a reality, many investment decisions are adopted or dismissed due to environmental aspects, and most of all, consumers increasingly choose the products that they buy considering their environmental performance and image. The environmental image of products is, therefore, paramount not only for their access to markets but also for their success in markets.

The question is then, how important are environmental considerations at the time of deciding how much money to invest in environmental and human health research themes?
This paper discusses some key aspects at the time of deciding what to do, how to do it, and most of all, how much to
A Comparative Study of the Adsorbed Pb (II), Cd (II) and Zn (II) on Smectite, Kaolinite and Illite, using XPS

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X-ray photoelectron spectroscopy (XPS) method was used to study the adsorption of lead, cadmium and zinc ions from 0.5 M acetate solutions for 20, 40, and 60 hours on the natural clay minerals: smectite, kaolinite and illite. All clay minerals are able to adsorb heavy metals, but they differ in their adsorption capacities. After 20 hours, illite has higher adsorption capacity to Zn, Cd and Pb as compared with smectite and kaolinite. This relatively greater adsorption capacity of illite to heavy metals may be attributed to a relatively higher interlayer charge of illite, as compared with smectite and kaolinite. After 40 hours, desorption of Cd ions in water exceeded that of the Pb and Zn ions, which may be explained by relatively high mobility of cadmium. After 60 hours, the amount of adsorbed heavy metals increased on the three studied clay minerals. The high extent of heavy metals accumulation on the kaolinite may be attributed to the affinity of metal ions to coordinate with the surface functional groups, forming surface complexes.

Keywords: XPS – Adsorption – Heavy metals – Clay minerals – Surface complexes

Etude comparative du Pb (II), Cd (II), et Zn (II) dans le smectite, caolinite et illite, à l’aide de la spectroscopie aux photoélectrons radioscopiques (XPS)

Estudio comparativo de la adsorción de Pb (II), Cd (II) y Zn (II) en smectita, kaolinita y illita por XPS

1 Introduction

Heavy metals are often introduced to the environment through human activities at sites related, for example, to metal mining and metallurgical processing and waste disposal. Heavy metals adsorption on clay minerals has been intensively studied in laboratory, as well as in field experiments [1], to evaluate the use of clays as remedial agents in contaminated waste deposits and other areas of heavy metal concentrations [2]. Usually, the experimental approach involves the study of metal ion sorption in bulk soils, sediments and pure clay minerals. Adsorption is one of the most important processes of metal uptake that take place at the mineral-solute interface. In particular, the study of sorption behaviour of toxic heavy metals by clay mineral surface is of great importance.

The basic crystalline structure of clay minerals consists of two main structural units. The first unit forms layers of (Si, Al)O₂-tetrahedrons which are bonded over the oxygen atoms in one plain; the second structural element consists of octahedrons in which the central ion (mostly aluminum but