Mineral Recycling Forum 2016 Review

Mike O’Driscoll

IMFORMED launched successfully the Mineral Recycling Forum in Rotterdam during 14-15 March 2016. Over 100 delegates came away enriched with knowledge and new contacts for one of the fastest evolving industrial mineral sectors: raw materials from recycled waste products.

Welcome reception

Mineral Recycling Forum 2016 commenced with a most convivial and well-attended Welcome Reception sponsored by LKAB Minerals. Darren Wilson, Chief Operating Officer of LKAB Minerals, warmly welcomed delegates, underlining the importance of this growing sector and LKAB’s commitment to the development of secondary raw materials (the company recently opened a mineral recycling plant in Moerdijk). During the Forum, thirteen presentations from experts covered a wide range of topics including: industrial mineral life cycles, minerals recovery from waste, recycling refractories, laser-based sorting technology, secondary raw materials from steelmaking, alumina from aluminium salt slag, recycling red mud, cenospheres from fly ash, silica fume sourcing and markets, and phosphorus from waste water.

A reality rain check

Following an introductory presentation by Mike O’Driscoll setting mineral recycling in the context of the industrial minerals supply chain, Didier Jans, Director General,IMA-Europe, presented “Life cycle of industrial minerals: an industrial perspective”. Jans reminded how “industrial minerals are at the basis of manufacturing industry”, providing examples of industrial mineral content in products such as glass, 100 %, paper, 50 %, paint, 50 %, and automobiles, 100–150 kg/car.

With a welter of pan-European recycling initiatives and legislation on the go, Jans suggested a “reality rain check” was in order between the European Commission and the industry for the future of recycling. Core to understanding what makes sense, is an appreciation that there are simple and complex cases in the value chain. Jans illustrated this with reference to the life cycles of the aluminium can, paper, and glass.

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He concluded with a review of drivers and limits prolonging the life of minerals, and that there is no one-fits-all recipe for value chains. All materials are equal: no “secondary” stigma

Nenad Tanasic, Managing Director, Minerals/UK, presented the first of four presentations focused on a major source of minerals and the parties involved at each stage to establish a sustainable operation and develop strategic partnerships. The company’s new Maidrik plant has 12,000 m³ dedicated to recycling.

Spent refractory processing and applications were outlined, as well as LKAB’s recent standardisation of recycled refractory materials into magnesia- and alumina-based products. Bradley concluded: “The market for recycled materials will continue to grow, while strategic partnerships are critical to maintain the supply chain.” He also added that a strong focus is required to improve sorting techniques.

Werner Odreitz, Purchasing Director, Secondary Raw Materials, RHI AG/AT, delivered his presentation “Recycling refractories from an end user’s viewpoint” with a personal story to someone devoted to the philosophy of mineral recycling by declaring that we should not brand such products as “second-rate” and thereby receive as a commendable move to increase the consumption rate of secondary raw materials.

To one of the key areas of technical advancement in mineral recycling: laser-based sorting.

Christian Bohling, CEO, Secopta GmbH/DE, explained all in his talk “Laser-Induced Breakdown Spectroscopy (LIBS) in recycling of refractory material outbreak”. The basics and advantages of using fully automated LIBS in recycling were outlined, described as “universal”, “flexible”, “fast”, “accurate”, “efficient”, “secure”, “non-destructive”, “environmentally friendly” and “low cost”.

The refractories recycling session concluded with a fine example of material recycling in practice at one of the world’s leading stainless steelmakers, Acciai Speciali Terni, as described by Marc Faverjon, Sales Engineer, Defref SpA in “The circular economy concept at a stainless steel plant: a secondary raw material source of minerals.”

The project started in January 2013, and came to fruition in February 2014, in 2015 almost 19 000 t of refractory material was reprocessed from EAF, ladles, and AOD vessels, as well as 13 000 t of steel.
Recovered magnesia and dolomite was re-used by AST in slag conditioning, saving an estimated 15 300 tpa of lime consumption, used by AST in slag conditioning, saving an estimated 15 300 tpa of lime consumption.

**Secondary alumina from salt slag**

Howard Epstein, Technical Consultant, RVA, presented “Recycled alumina from aluminium salt slag: origins & applications”, explaining the source, nature, market applications and drivers of this recycled alumina product. RVA essentially processes the salt slag generated from secondary aluminium processing from aluminium scrap, yielding a “secondary” alumina which can be used in non-metalurgical alumina markets. Approximately one tonne of secondary aluminium produced yields 550 kg salt slag, which can yield 300 kg of secondary alumina. Potential world production of secondary alumina is about 3,1 Mt/year.

Epstein outlined key drivers of this recycling loop as including environmental regulations that prohibit landfilling of aluminium salt slag, and lower production costs compared to primary alumina production. RVA’s product, called Valoxy, contains 67% alumina, and has current and potential use in cement, insulation products, stainless steel slag stabilisation, fire resistant geopolymers, and calcium aluminate steel refining powders. Epstein highlighted Valoxy use in cement production and as a substitute for borax in stabilising AOD steel slags.

**Red mud source for mineral wool & cement**

In “Valorisation of bauxite residue (red mud): in pursuit of a technologically realistic and financially viable process”, Dr Yannis Pontikes, Senior Researcher, Sustainable Metals Processing & Recycling, KU Leuven/Institute of Materials Science of the University of Liège, presented “Cenospheres: an overview of their sources, properties and applications”. Pontikes described some of the ongoing research into red mud market applications, and said: “The message to take home is that there is work being done and that reality is region/plant specific.” The Mud2Metal project was described, showing how rare earth elements can be recovered and from the resulting alumina slag, mineral fibres, aluminate cements, and geopolymers can be processed.

**Laser based analysis of slag**

Continuing the theme of slags, their analysis using laser-based inline systems was described by Dr Cord Fricke-Begemann, Group Manager, Materials Analysis, Fraunhofer-Institut für Laser Technik ILT in “Laser-based inline analysis of slags and refractories.” The different categories of slags, their sources, and market applications were described. Fricke-Begemann noted: “Their classification as ‘by-product’ or ‘waste’ is not uniform throughout the EU.” This has important implications for their handling and recycling. The slag chemistry is all-important and dictates its value and potential uses. Inline analysis of liquid slag at voestalpine Stahl Linz was described using LIBS. The challenges in non-destructive identification and sorting of refractories in the REFRASORT project were also described.

Fricke-Begemann concluded: “Inline laser analysis of minerals enables high-grade recycling, and such innovative laser approaches open up new perspectives for the minerals industry.”

**Cenospheres from fly ash**

One of the well-established SRM over the years has been fly ash. Erwin Grossman, Head of Sales, Mine Feuerfest GmbH, presented “Silica fume: the fusion by-product” in “Silica fume and its market applications”.

Silica fume is a by-product in the carbothermic reduction of high-purity quartz with carbonaceous materials like coal, coke, wood-chips, in electric arc furnaces in the production of silicon, ferrosilicon alloys and fused zirconia. Silica fume comprises spherical particles less than 1 μm in diameter, and of key significance for market applications, possesses a surface area of approximately 15 000–30 000 m²/kg.

Of particular interest was the story related to RW Silicium, essentially treating silica fume as a waste product many years ago and landfilling a site with the material. Through working with mineral processor KTS Karlsbader Ton-und Schamottewerke Mannheim & Co. KG, Cofermin has been exploring the former RW Silicium silica fume “deposits” for a range of applications.