

Zinc for life

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INCREASINGLY, the mining and metals industry is being asked to provide information to downstream industries on the environmental footprint of the materials it produces. Key end-use markets, such as building and construction, electronics and transport, are becoming more interested in selecting materials that have the best environmental (and social) profile, while meeting traditional cost, quality and technical performance criteria.

Understanding the environmental footprint of metals begins with documenting the resource requirements (energy and non-energy) and environmental releases associated with upstream operations (such as mining and refining). But it also involves understanding the impact and, most importantly, the benefits of using metals during other stages in the life cycle of the products of which they are an ingredient.

The global zinc industry is one sector that is working to better quantify the environmental impacts and benefits of production, and to communicate this information to key markets and stakeholders.

BENEFITS OF ZINC

Zinc is present naturally in rock and soil, air, water and the biosphere, and it is a material that is essential to human, animal and crop health. Zinc has important anti-corrosion properties that extend the life of many steel products and it can also be recycled indefinitely, without loss of any physical or chemical properties.

These inherent characteristics of zinc – natural, essential, durable and recyclable – make it a desirable material for a range of applications in transport, infrastructure, consumer products and food production. Many of these applications contribute to sustainable development in other industry sectors; for example, by improving product durability or crop yields.

The zinc industry understands that to demonstrate the sustainability of zinc properly, data and information is required that enables users of zinc to evaluate its impact and benefits across the entire life cycle – from raw-material extraction to end-of-life recycling.

DEVELOPING THE INFORMATION BASE

The International Zinc Association (IZA) launched the Zinc for Life programme in 2006 to provide scientific information about the sustainability performance of zinc and to position it as a material of environmental choice for engineers, architects and other individuals involved in the specification of materials.

The Zinc for Life initiative has two complementary components: methodology and data generation, which focuses on providing up-to-date and scientifically sound life-cycle data on zinc and zinc products, as well as contributing to life-cycle assessment of relevance to zinc; and outreach,

Mining companies are increasingly being asked to prove the sustainability credentials of the minerals they produce

which involves the analysis of sector-specific environmental information needs and requirements, and expectations in zinc-consuming industries, and from other key stakeholders, and establishing appropriate outreach and communication strategies.

LIFE CYCLE ASSESSMENT

The generation of robust and representative life cycle assessment (LCA) studies on primary zinc, as well as key first-tier applications – zinc sheet, hot dip galvanizing and die-casting – form a key part of the methodology and data-generation component of the Zinc for Life programme.

Life cycle assessment was chosen by the IZA because it is the most widely used method for understanding the environmental performance of materials, and it is used by many end-use markets to support material selection and product development.

Standardised by the International Organization for Standardisation (ISO), life cycle assessment helps companies to measure, assess and manage the environmental performance of a product system from the raw material through production, use and end-of-life phases.

The first phase of Zinc for Life is now complete. The backbone of the programme is the life cycle study on primary zinc production. This 'cradle to gate' analysis provides life cycle inventory (LCI) data for primary zinc (ingot at refinery gate).

Data for the study was provided by IZA members responsible for 614Mt of ore and 4.2Mt of zinc concentrate production. For smelting, about 3.38Mt of refined zinc was represented in the study.

This data coverage represented 44% of global zinc mine production and 32% of the global zinc production volume for the reference year 2005. This

number is considered high for a global study conducted for the first time and therefore the resultant, final LCI on primary zinc production is considered representative of the industry.

STUDY RESULTS

To support the study, IZA members provided data on energy and materials use, and environmental releases from the extraction of the zinc ore at the mine site to the production of primary zinc and the

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shipment of zinc ingots from the gate of the facility at which it is produced.

Primary data was used for the main unit processes of zinc production while secondary data from a variety of sources was used to model upstream materials production – fuel, auxiliary materials, electricity, etc.

The study also looked at five impact categories: primary energy consumption; global warming potential; acidification potential; eutrophication potential, and photochemical oxidant-creation potential (POCP). It was found that primary energy demand ranged from 35,000-76,000MJ/t of special, high-grade zinc.

Variations in the figure were influenced by three main factors: the different characteristics of country-specific power-grid mixes (primary energy demand per kWh of electricity generated); differences in energy efficiency for special, high-grade zinc production; and differences at the production sites, with some being more integrated plants producing numerous co-products or, in some cases, zinc is not even the major metal produced.

Zinc's carbon footprint was found to be approximately 3t of CO₂ equivalent per tonne produced. As with any material, the carbon footprint of zinc is best understood in relation to the products in which it is used. For example, zinc's anti-corrosion properties can extend the life of a variety of steel products and reduce their overall impact, therefore making them more sustainable.

USES

The data generated for this LCI on special, high-grade zinc can be used for a range of applications, including:

- Input data for 'cradle to grave' evaluations of second- and third-tier applications (rolled zinc sheet and galvanized utility poles);

- Provision of data to life cycle data sets on materials/products – these databases are being developed in a variety of countries and regions around the world, and are being used by product manufacturers and architects to support material selection;
- Supporting the calculation of the carbon footprint of zinc-containing products;
- Evaluation of the relative contributions and impact of zinc and zinc-containing products to sustainable production and consumption.

In addition to the primary zinc study, additional studies were undertaken on zinc sheet, hot-dip galvanizing and die-casting. The Zinc for Life

programme also conducted some internal studies on different tier-two applications to better understand the relative strengths of zinc products versus competing products.

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BEYOND LIFE CYCLE DATA

The primary zinc and zinc-sheet life cycle data will be available on the Zinc for Life website. This also offers general information on sustainability and zinc, a sustainability report, information on the key issues related to the treatment of metals in life cycle studies (eg recycling), the IZA's sustainability charter and guiding principles.

These principles cover key issues such as business ethics, community consultation, employee health and safety, mine closure, managing minor elements, sustainability reporting, mine tailings and residue management, environmental management systems and product stewardship.

FUTURE WORK

Through the Zinc for Life programme, the zinc industry is doing its part to better understand and respond to growing information on the sustainability of its main products. It has also raised awareness among the IZA members and will continue to work with other actors in the zinc value chain (such as the American Galvanizers Association and Worldsteel Association), to communicate and demonstrate its sustainability benefits.

The IZA will also continue to monitor end-use market requirements, life cycle databases and the criteria of leading evaluation schemes that influence material selection, and it will provide information to these schemes and databases as needed.



Main photo: San Cristobal zinc mine, Bolivia
Above: zinc rod manufacture, Nanophanse Technologies
Below: zinc alloy bars used in industry

Photos: Bloomberg News

SUSTAINABILITY ATTRIBUTES

Zinc is Natural

Zinc is present naturally in rock and soil, air, water and the biosphere.

Zinc is Essential

All living organisms – plants, animals and humans – need zinc to live.

Zinc is Durable

Zinc extends the life cycle of steel and reduces maintenance costs.

Zinc is Sustainable

Zinc can be recycled indefinitely, without loss of its physical or chemical properties.

Zinc is Vital

Zinc is vital for construction, food production, health, pharmaceuticals, infrastructure, transport... for life itself.

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