Extractive Metallurgy of Rare Earths

Krebs. D. G.

1.Principal Process Consultant, Primero, Osbourne Park, WA, 6017, Damien.krebs@primero.com.au

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# ABSTRACT

The extractive metallurgy of rare earths is characterised by continual innovation, reflecting the growing applications for these critical materials in various high-tech industries. The evolution of extraction methods is driven not only by the need for efficiency but also by an increasing emphasis on environmental sustainability and geopolitical independence.

Historically, REE extraction has been a complex and environmentally intensive process. These elements are typically dispersed in low concentrations, necessitating large-scale open pit mining and extensive processing to extract them in usable forms. Commercial extraction is typically chemical-intensive hydrometallurgical processes, posing significant environmental and technical challenges.

The extractive metallurgy of rare earths is a complex field that is just as much an art as it is a science. Much of the technology of the industry is hidden behind the red curtin as China are world leaders in rare earth extractive metallurgy. This leadership has developed from China rising to become the dominant supplier of rare earth raw materials from a variety of mines. Not only does China dominate the rare earth raw material supply but also the downstream processing of rare earths into a host of specialist chemical products.

Meeting rare earth demand necessitates a multi-pronged approach that encompasses not only the development of new extraction technologies but also the establishment of robust, sustainable, and geopolitically diverse supply chains. The ongoing innovation in REE extraction is a critical component of this endeavor, requiring collaborative efforts from researchers, industry stakeholders, and policymakers to ensure a sustainable and secure supply of these indispensable elements for the future

This presentation will provide the viewer with an introduction to the extractive metallurgy of rare earths covering all major deposit types. The key rare earth bearing minerals will be presented and discussed from a metallurgical amenability point of view. The major processing steps will be covered in a sequential process showing the equipment and chemistry involved.

It is a broad presentation for a technical target audience to transfer some of the authors learnings from his work in rare earths since 2010.