

MoCa – Developing a production chain for rare earth elements in Brazil

Client II – International partnerships for sustainable innovations

The high-tech industry would be nothing without rare earths. Brazil has the second-largest reserves of rare earths in the world after China. In order to secure the long-term supply of these special metals, Brazilian and German researchers have joined forces in the “MoCa” collaborative project. The partners analyze the extraction potential of rare earths from previously unused mining tailings from the Catalão deposit in the Brazilian state of Goiás. The factors of cost-effectiveness and sustainability are taken into account as these processes are developed.

Recovering rare earth elements

With 22 million tonnes, Brazil has the second-largest reserves of rare earths in the world. Despite this great potential, only a small amount of rare earths is currently being produced on an industrial scale in Brazil. Since Brazil has supported the development of its own rare earth production for several years and Germany has a large demand for rare earth products, the two countries have entered into a strategic partnership.

One of the most important rare earth deposits in Brazil is the ultramafic alkali-carbonatite complex located at Catalão in the state of Goiás. The company CMOC International Brasil is currently mining the deposit for its apatite and pyrochlore content to be used in the production of fertilizers and ferriobium. In addition to minerals containing phosphate and niobium, the ore also contains rare earth minerals. Currently, the deposit’s rare earth minerals are not extracted but instead deposited as mining residues.



View of the mine in Catalão in the Brazilian state of Goiás.

“MoCa” aims to investigate the extraction potential of rare earths, both from residues from current production and

deposited residues at the Catalão site. Once the process is developed, its competitive capacity and sustainability will be examined according to economic considerations and life cycle assessments. These analyses will then be used to map out the advantages of rare earth extraction from mining residues compared to conventional extraction from primary materials.

Exploration of mining residues

Modern methods for characterizing mining residues are based on innovative remote sensing technologies and sensors. In addition to conventional remote sensing methods, the “MoCa” project also performs hyperspectral analyses from drone overflights to obtain detailed information on height grading and enrichment zones of rare earths. Furthermore, work will be done to develop the combined use of a core penetration method and X-ray fluorescence analysis in order to carry out simultaneous detection and quantification of the rare earths on site. A 3D model of the mining tailing will be created based on the remote sensing and sensor data. The model can then be used as a basis for targeted mining to extract rare earths.

Processing mining tailings

Mineralogical and chemical analyses will be used to develop innovative processes for the efficient extraction of rare earths from selected mining residues from current production.

In the first step, the rare earths are to be enriched in a concentrate. Due to the very small particle sizes that are expected and the complex mineral composition, the mechanical processing experiments will concentrate on magnetic separation, density separation, and flotation. In addition, solutions for dewatering concentrates and waste

streams resulting from mechanical treatment will also be developed. Using the laboratory results, an overall process will be designed and validated on a small scale.

In the second step, wet chemical processes will be used to produce a pure mixed rare earth oxide. The safe and efficient separation of impurities will be a top priority in developing the process.



Flotation investigations are a central part of process development.

Strategy for industrial implementation

At the end of the project, a detailed roadmap will be drawn up on the basis of the investigations. This will specify how to implement the developed processes on an industrial scale to extract rare earths from the mining tailings at the site in Catalão. The strategy will include relevant milestones as well as information on key challenges and possible solutions.

Funding initiative

Client II – International partnerships for sustainable innovations

Project title

MoCa – Developing a production chain for rare earth elements from trailings of the ultramafic alkali-carbonatite complex in Catalão/Goias

Duration

01.01.2018–30.09.2021

Funding code

033R189A-D

Funding volume

2,265,448 Euro

Contact

Kirstin Schneider
Technical University of Clausthal
Institute of Mineral and Waste Processing, Waste Disposal
and Geomechanics
Walther-Nernst-Straße 9
38678 Clausthal-Zellerfeld, Germany
Phone: +49 5323 72-2961
E-mail: kirstin.schneider@tu-clausthal.de

Project partner

Helmholtz-Institute Freiberg for resource technology; Öko-Institut e. V.; FUGRO Germany Land GmbH; CMOIC International Brasil; Universidade Federal de Goiás; Escola Politécnica da Universidade de São Paulo

Internet

bmbf-client.de

Published by

Bundesministerium für Bildung und Forschung/
Federal Ministry of Education and Research (BMBF) Division
Resources, Circular Economy; Geosciences
53170 Bonn, Germany

December 2020

Editing and layout

Project Management Jülich (PtJ), Forschungszentrum Jülich
GmbH; adelphi research gGmbH

Photo credits

Technical University of Clausthal