Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **4150** Type: **Poster not-in-competition (Graduate Student) / Affiche non-compétitive (Étudiant(e) du 2e ou 3e cycle)**

(G) (POS-59) A Multimodal Approach Towards Advancing the Characterization and Analysis of Erbium

Tuesday 28 May 2024 17:49 (2 minutes)

Erbium is one element in the globally-recognized class of critical minerals, the rare earth elements (REE's). It is an essential component in various clean energy and modern technology applications from nuclear control rods to infrared optics. Growing demand for these high-tech applications alongside geopolitical supply chain risks underscore the critical status of REE's. To address this, it is of interest to advance resource development through all available means, including both mining and recycling. In order to develop and maintain responsible resource management strategies, it is crucial to be able to reliably identify and quantify rare-earth-containing materials and to have a comprehensive understanding of their properties.

This work presents an effort to advance current methodologies surrounding the analysis and characterization of rare-earth-containing materials, with a focus on erbium. Using several analytical techniques such as X-ray Photoelectron Spectroscopy (XPS), Secondary Ion Mass Spectrometry (SIMS), and Rutherford Backscattering Spectroscopy (RBS) we are developing robust characterization procedures for various erbium-containing materials. By identifying subtle binding energy shifts and structural variances in the complex XPS signals of erbium compounds, we are developing novel and practical standard curve-fitting procedures. These fitting procedures will serve as reference data to allow for the future identification and Er content quantification of these compounds in unknown erbium-bearing materials. We are also exploring the fabrication of element-specific SIMS standards through ion implantation, as more representative standards will allow for more accurate quantification of those elements in materials. Using both Al-Kα and high-energy Ag-Lα XPS sources in conjunction with elemental mapping via Energy Dispersive X-ray spectroscopy, we have also identified several light REE's residing in interstitial grain boundaries between barite and calcite mineral grains within bastnaesite ore. Collectively, these techniques provide a strong foundation for our understanding of the composition, electronic structure, and surface chemistry of erbium-containing materials. These advancements are critical for optimizing the extraction and recycling processes by increasing the processing yield, efficiency, and by reducing waste.

Keyword-1

XPS

Keyword-2

RBS

Keyword-3

Ion implantation

Author: BUCHANAN, Sage (Department of Physics and Astronomy, Surface Science Western, The University of Western Ontario)

Co-authors: Dr GONCHAROVA, Lyudmila (Department of Physics and Astronomy, The University of Western Ontario); Dr BIESINGER, Mark (Department of Chemistry, Surface Science Western, The University of Western Ontario)

Presenter: BUCHANAN, Sage (Department of Physics and Astronomy, Surface Science Western, The University of Western Ontario)

Session Classification: DCMMP Poster Session & Student Poster Competition (11) | Session d'affiches DPMCM et concours d'affiches étudiantes (11)

Track Classification: Technical Sessions / Sessions techniques: Condensed Matter and Materials Physics / Physique de la matière condensée et matériaux (DCMMP-DPMCM)