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BOOK of ABSTRACTS

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Greenhouse gas emission from the rare earth metals electrolysis

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Rare earth metals, mainly related to neodymium, praseodymium or dysprosium are usually produced by molten salt electrolysis in which oxy-fluoride or chloride molten salt systems are used as the electrolytic bath. Minimizing the perfluorocarbon compounds (PFC) emission in rare earth electrolysis should be the primary goal owing to their high global warming potential¹. There is growing interest in the oxygen and fluoride ions oxidation reactions on the graphite anode, particularly in the mechanism of C-F in the PFC formation. In the present work, we investigated the off-gas emission during the Nd and Pr electrodeposition from oxy-fluoride melts by the in-situ FTIR-spectrometry to understand the nature of the reactions taking place on the anode and the mechanisms behind them. During the electrolytic reduction of rare earth metals in the oxy-fluoride system with tungsten or molybdenum used as cathode, tungsten as a reference electrode and a GC electrode used as an anode, the produced oxygen species subsequently react with carbon and generate CO and CO₂. With F⁻ ions present, PFC compound emission, such as CF₄ and C₂F₆ gases also can be evolved from the GC anode as well. During the electrolysis, carbon monoxide was evolved in variable quantities, but always below 1000 ppm. Evolved quantity of CO₂ was around 200 ppm during the potentiostatic deposition. The quantity of recorded CF₄ was well below 10 ppm. At the same time C₂F₆ was not detected under the applied potentiostatic regime of the electrolysis. To suppress greenhouse gas emissions and to achieve high-purity Nd and Pr metal production on the working substrate we chose low-deposition overpotential.

Keywords: rare earth metals, electrodeposition, greenhouse gas emission

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