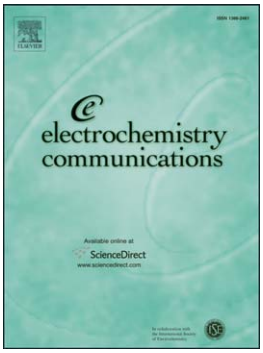

Enhanced electrochemical reduction of rare earth oxides in simulated oxide fuel via co-reduction of NiO in Li_2O-LiCl salt

Min-Woo Lee, Eun-Young Choi, Sang-Chae Jeon, Jeong Lee, Sung-Bin Park, Seungwoo Paek, Michael F. Simpson, Sang Mun Jeong

PII: S1388-2481(16)30199-0
DOI: doi: 10.1016/j.elecom.2016.08.021
Reference: ELECOM 5765

To appear in: *Electrochemistry Communications*

Received date: 25 July 2016
Accepted date: 24 August 2016

Please cite this article as: Min-Woo Lee, Eun-Young Choi, Sang-Chae Jeon, Jeong Lee, Sung-Bin Park, Seungwoo Paek, Michael F. Simpson, Sang Mun Jeong, Enhanced electrochemical reduction of rare earth oxides in simulated oxide fuel via co-reduction of NiO in Li_2O-LiCl salt, *Electrochemistry Communications* (2016), doi: 10.1016/j.elecom.2016.08.021

Enhanced electrochemical reduction of rare earth oxides in simulated oxide fuel via co-reduction of NiO in Li_2O-LiCl salt

Min-Woo Lee,[a,†] Eun-Young Choi,[b,†] Sang-Chae Jeon,[b] Jeong Lee,[b] Sung-Bin Park,[b] Seungwoo Paek,[b] Michael F. Simpson,[c] and Sang Mun Jeong[a,*]

[a]Department of Chemical Engineering, Chungbuk National University, Cheongju, Chungbuk 28644, Republic of Korea

[b]Korea Atomic Energy Research Institute, Yuseong-gu, Daejeon 34057, Republic of Korea

[c]Department of Metallurgical Engineering, University of Utah, Salt Lake City, UT 84112, USA

Abstract

Rare earth oxides in spent oxide fuel from nuclear plants have poor reducibility in the electrochemical reduction process, due to their high oxygen affinity and thermodynamic stability. Here we demonstrate that the extent of their reduction can be enhanced via co-reduction of NiO in a Li_2O-LiCl electrolyte for the electrochemical reduction of a simulated oxide fuel (simfuel). First, the electrochemical behaviors of Nd_2O_3, NiO, and Nd_2O_3-NiO were studied by cyclic voltammetry and voltage control electrolysis. Then, the electrochemical reduction of the simfuel containing UO_2 and rare earth oxides (Nd_2O_3, La_2O_3, and CeO_2) was conducted in molten LiCl salt with 1 wt.% Li_2O via the co-reduction of NiO. The extent of reduction of the rare earth oxides was found to be significantly improved.

Keywords: pyroprocessing, electrochemical reduction, molten salt, spent oxide fuel, rare earth oxides

*Corresponding author. Tel.: +82-43-261-3369, E-mail: smjeong@chungbuk.ac.kr
†These authors contributed equally to this work.