In situ EXAFS studies of photoelectrocatalytic reduction of gold and lanthanum ions recycled from E-wastes

1st T.-E. Wu
Department of Environmental Engineering,
National Cheng Kung University
Tainan, Taiwan
emily2738tw@gmail.com

2nd Y.-C. Tsai
Department of Environmental Engineering,
National Cheng Kung University
Tainan, Taiwan
jack1998870308@gmail.com

3rd Y.-J. Tuan
Department of Environmental Engineering,
National Cheng Kung University
Tainan, Taiwan
eugenet@ncku.edu.tw

4th H. Paul Wang
Department of Environmental Engineering,
National Cheng Kung University
Tainan, Taiwan
wanghp@ncku.edu.tw

Abstract

Recycling of rare precious metals (RPMs) from E-waste by traditional methods such as pyrometallurgy and hydrometallurgy are generally high energy consumption, cost, and risk of environmental pollution. In this study, fluid capacitive deionization (FdCDI) process was used to concentrate the RPMs from a wastewater. The solar-driven photoelectrocatalytic (PEC) reduction of RPM ions (such as Au^{3+} and La^{3+}) to metals was investigated. Electrons jumped to an excited state by solar energy can be transferred to photocathode through the external circuit to generate electricity in the PEC-I. In the solar-driven PEC-II on the photoanode, the photo-generated electrons can cause the reduction of RPM ions to metals. The speciation of gold and lanthanum during the FdCDI processes was determined by X-ray absorption near structure (XANES) spectroscopy for a better understanding of their electronic structure and oxidation states during photoelectrocatalysis, their synchrotron extended X-ray absorption fine structure (EXAFS) spectra were also determined for an improvement of the photoelectrocatalysts.

Keywords: *photoelectrolysis, FdCDI, RPMs, XANES, EXAFS.*

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