ELECTROCHEMICAL REDUCTION OF Eu(III) FOR THE RECOVERY OF Eu FROM RARE EARTH MATERIALS SOLUTION

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Europium is one of the most important rare earth (RE) elements. It is widely used as a component of cathode ray tubes, with screen coated with red phosphor, as phosphorescent pigments, and in laser optics. It can also keep used as neutron-absorbing material. In aqueous solutions, RE principally exists as a stable trivalent species. Separation of Eu (III) from other RE (III) is problematic because their chemical properties are similar. Reduction of Eu (III) to its divalent state enables its subsequent separation from RE (III) by means of Eu (II) sulfate precipitation. Chemical reduction using zinc or zinc amalgam is the traditional method, and other techniques based on electrochemical reduction. Electrochemical reduction of Eu (III) does not give rise to Zn (II) impurity unlike chemical reduction and also proceeds faster than chemical reduction. Therefore, the feasibility of Eu (III) electroreduction was investigated.

The redox potential of Eu (III)/Eu (II) is much more negative to hydrogen evolution potential. Simultaneous hydrogen evolution with the reduction of Eu (III) to Eu (II) induces decreased current efficiency, which adds markedly to cost. Suppression of hydrogen evolution is required to get high current efficiency. Initially, Graphite, Zr and glassy carbon, which is known as high hydrogen evolution (HE) overpotential material, was used as working electrode. In Figure 1, Zr and glassy carbon shows much higher HE overpotential than graphite. However, little reduction of Eu (III) was observed for Zr (Figure 2). Therefore, glassy carbon among three electrode materials showed best performance.

More details will be discussed in the presentation.

Figure 1. Cyclic voltammograms in 0.01 M HCl.

Figure 2. Cyclic voltammograms in the mixture of 0.01 M HCl + 7.6 mM EuCl₃.