

【Grant-in-Aid for Scientific Research (S)】
Science and Engineering (Engineering)



Title of Project : Development of Environmentally Sound Recycling Technology for Precious Metals and Rare Metals

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Research Project Number : 26220910 Researcher Number : 00280884

Research Area : Metal making, Resource production engineering

Keyword : Recycling, Precious metal, Rare metal

【Purpose and Background of the Research】

Rare metals are essential to producing energy-saving and high-tech products. Global competition for securing rare metal resources is becoming increasingly intense. In Japan, the combination of limited domestic natural resources and strict environmental regulation makes it vital to develop a highly efficient and environmentally sound recycling process for rare metals.

Precious metals (PMs) such as platinum and rhodium are quite scarce and expensive. However, their use in industrial applications such as autocatalysts should ensure that their demand, and the need for resource recovery by recycling, will increase markedly in the future.

PMs are generally recovered through dissolution in aqueous solutions, but their high chemical stability inevitably requires long processing times. Furthermore, a large amount of toxic waste is generated by the combination of acids and strong oxidants such as Cl_2 gas or aqua regia that are used to dissolve PMs. In this study, we developed effective processing technologies to more rapidly dissolve PMs without generating toxic waste, with such technologies also applied to other rare metals.

【Research Methods】

In previous studies, we found that PMs can only be dissolved effectively by hydrochloric acid when they are pretreated by alloying and chlorination to convert them into complex chlorides before dissolution procedure.

In this study, we establish a synthesis method for various complex chlorides of PMs, while also identifying the chemical states and dissolution behavior of PMs in hydrochloric acid and salt water. Based on these findings, we will establish an environmentally sound recycling process for PMs-containing scraps, as shown in Figure 1.

Following the fiscal year of 2016, these newly developed PM recycling techniques will be applied to developing a novel recycling process for rare earths (Dy, Nd, etc.), rhenium, tungsten, etc.

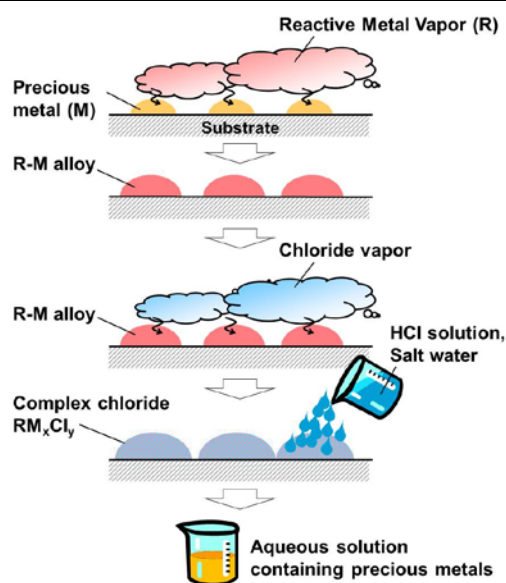


Figure 1 Environmentally sound recycling process based on the novel dissolution technique developed through this study.

【Expected Research Achievements and Scientific Significance】

The chemical properties of complex PM chlorides will be systematically studied, with the ultimate goal of recycling rare metals from various scrap materials by dissolving them by salt water. This innovation in recycling will eliminate the need for an acid or oxidant, and represent an important step toward the realization of a sustainable society.

【Publications Relevant to the Project】

- C. Horike, K. Morita, and T. H. Okabe:
Metallurgical and Materials Transactions B, vol.43B (2012) pp.1300-1307.
- T. H. Okabe, Y. Kayanuma, S. Yamamoto, and M. Maeda:
Materials Transactions, vol.44 (7) (2003) pp.1386-1393.

【Term of Project】 FY2014-2018

【Budget Allocation】 147,900 Thousand Yen

【Homepage Address and Other Contact Information】

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