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MAEDA LAB.

[Advanced materials processing]
-Underpotential dissolution of precious metals and refining of low-grade copper-

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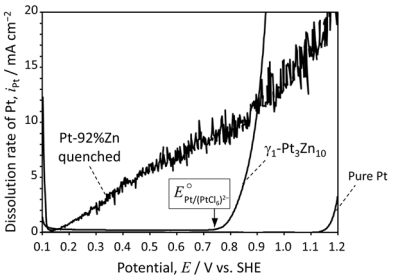
Department of materials engineering

Recovery and Waste Technology

Recycling of precious metals using “underpotential dissolution” of alloys

Dissolution of precious metals can be enhanced by alloying. We applied an electrochemical technique to examine the enhanced dissolution quantitatively, and observed “underpotential dissolution” for the first time.
In refining and recycling processes, precious metals are dissolved by chemical agents which entail the burden of a large environmental load. We are developing an easier process which makes use of the metal dissolution enhanced by alloying.

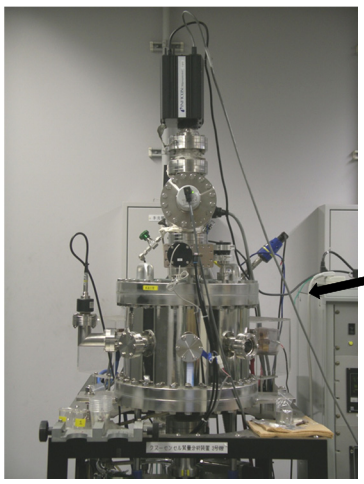


Potential dependency of Pt dissolution from Pt-Zn alloys.
H. Sasaki and M. Maeda, J. Phys. Chem. C, 117 (2013) 18457.

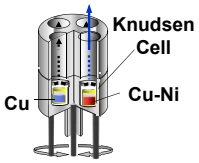
Refining of low-grade copper with reduced energy cost

In recycling of non-ferrous metals, low-grade copper cannot be purified by conventional electro-refining because it contains a wide variety of impurities. We are developing a new process to refine copper with reduced energy cost and to recover the valuable metals contained in it.

Reaction analysis using mass spectrometry



Evaporated species are detected for each molecular mass

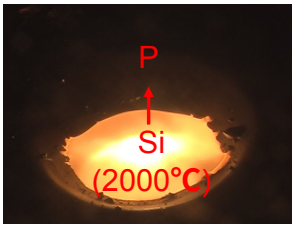


By rotating the cell holder, multiple samples can be measured sequentially under identical conditions

To develop and optimize materials processing at high temperature requires thermodynamic information on related chemical species (i.e., the formation energy of compounds, vapor pressure of gas species in equilibrium).
We are measuring thermodynamic properties of alloys and compounds using double Knudsen cell mass spectrometry.

Refinement of molten silicon

Solar-grade Si requires a purity of 99.9999%. Conventional refining processes for Si involve a large environmental load and high cost. We are developing a refining process using electron beams. Melted in a vacuum, some impurities evaporate preferentially from molten Si.



Drying of lignite using superheated steam

Lignite is a low-rank coal containing a great deal of moisture and accounts for 23% of the proven recoverable reserves of all coal. Because of the difficulty of transportation, it is used mainly as a fuel in thermal power stations located near source mines. With the increasing demand for energy, however, the use of low-rank coal is becoming important. We are studying the drying characteristics of Loy Yang coal in superheated steam.