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Recovery and separation of gallium(III) and germanium(IV) from zinc refinery residues: Part I: Leaching and iron(III) removal

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Abstract: In this research, gallium and germanium were separated and recovered from zinc refinery residues by a two-stage leaching. In the first leaching stage with sulfuric acid media, 92% of zinc and 94% of copper were leached resulting in significant gallium and germanium enrichment up to ca. 300%. In the second leaching stage with oxalic acid media, the effects of $H_2C_2O_4$ concentration, leaching time, liquid-to-solid(L/S) ratio and temperature on the recovery of gallium and germanium were investigated. More than 96% of gallium and 99% of germanium were leached out using 70 g/L $H_2C_2O_4$ with a L/S ratio of 10 at 90 °C for 2 h. The removal of iron in the $H_2C_2O_4$ leach solution was carried out using an ultrasound-assisted ferrous iron precipitation method in which more than 96% of Fe(III) was removed in the form of $FeC_2O_4{\cdot}2H_2O$ with minor losses of Ga(III) and Ge(IV) (1.4% and 1.3%). The results indicated that high recoveries of gallium and germanium from the zinc refinery residues could be achieved with two-stage leaching method.

Keywords: Zinc refinery residue; Gallium; Germanium; Oxalic acid leaching; Iron removal

1 Introduction

Gallium and germanium are important strategic resources that have been used extensively in a variety of high-technology fields, such as

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