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## Role of sodium citrate in leaching of low-grade and multiphase zinc oxide ore in ammonia–ammonium sulfate solution

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**Abstract:** In this paper, a novel system for leaching of low-grade and multiphase zinc oxide ore is presented, in which ammonia–ammonium sulfate is chosen as leaching agent, meanwhile adds a small amount of sodium citrate to strengthen the complexation behavior. The thermodynamics is studied by using chemical equilibrium modeling to predict the zinc species distribution diagrams for the Zn (II)-NH<sub>3</sub>-Cit<sup>3-</sup> system. Through employing various analytical technologies, such as X-ray diffraction (XRD), chemical analysis, and Fourier transform infrared spectroscopy (FT-IR), compositions, bond structures and chemical states are obtained. Moreover, effect of sodium citrate is studied by X-rays photoelectron spectroscopy (XPS) analysis, and it can be established that addition of sodium citrate is favorable for zinc leaching by inhabiting the formation of low complexation compound Zn(NH<sub>3</sub>)<sub>i</sub><sup>2+</sup> (i=1, 2) and lowering the fraction of Zn(NH<sub>3</sub>)<sub>3</sub><sup>2+</sup>. The leaching rate can reach 96.91 % with a cit<sup>3-</sup> concentration of 0.2 M/L. Once above it, diffusion rate of zinc would decrease, which causes the dropping of zinc leaching.

**Key words:** Sodium citrate; Low-grade and multiphase zinc oxide ore; Complexation; Hemimorphite

### 1 Introduction

With the depletion of natural sphalerite and increasingly stringent environmental

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