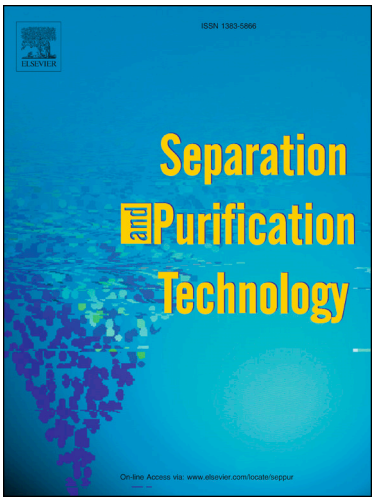

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Synchronous extractions of nickel, copper, and cobalt by selective chlorinating roasting and water leaching to low-grade nickel-copper matte

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Abstract

Due to the low recovery of valuable metals and the great loss of Co in the smelting process, the traditional pyrometallurgical process suffers to treat low nickel-copper matte efficiently. This work focused on a novel and controllable two-stage chlorinating roasting followed by a water leaching process to synchronously extract valuable metals from low-grade nickel-copper matte. The effects of first stage roasting temperature, roasting atmosphere, dosage of ammonium chloride, particle size of matte, first stage roasting time and second stage roasting temperature were studied. More than 99% of Ni, 99% of Cu and 96% of Co, whereas only 1.02% of Fe, were extracted under optimum conditions in which the first roasting temperature was 450°C, the proportion of O_2 was 10%, the dosage of ammonium chloride was 200%, the first roasting time was 1.5 h, and the second roasting temperature was 400°C. The chlorination mechanism and phase transformation during the two-stage roasting process were revealed using X-ray diffraction (XRD), scanning electron microscopy (SEM) and differential thermal and thermogravimetric analysis (DTA-TG). Thermal analysis kinetics method was used to analyze the kinetics in the chlorinating process, and the results showed that the first-stage roasting process has three stages to chloridize the metals in matte. Their apparent activation energies are 88.13 $kJ.mol^{-1}$, 338.61 $kJ.mol^{-1}$, and 252.27 $kJ.mol^{-1}$, respectively.

Keywords: low-grade nickel-copper matte; ammonium chloride; two-stage selective roasting; chlorination; kinetics; phase transformation

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