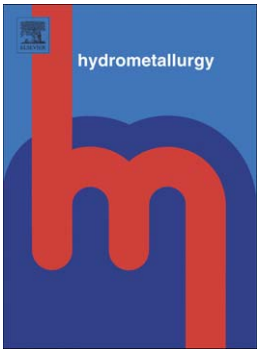

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An efficient method of chromium extraction from chromium-containing slag with a high silicon content

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Abstract: An efficient process was proposed for extracting chromium from chromium-containing slag after desilication with aqueous NaOH solution. The effect of the NaOH concentration, liquid-to-solid mass ratio, and leaching temperature on the leaching rate of silicon was investigated. The results showed that 83.78% of the silicon, 41.87% of the aluminum, and 46.42% of the vanadium were removed from the slag under suitable conditions. The kinetic analysis results showed that the leaching rate of silicon is controlled by a chemical reaction under two regimes due to the two silicon-bearing minerals presented in the slag. The first stage is limited by the reaction between NaOH and SiO_2, whereas the second stage is subject to the reaction between NaOH and $2MgO{\cdot}2Al_2O_3{\cdot}5SiO_2$. The corresponding apparent activation energies were calculated to be 67.27 kJ/mol and 35.82 kJ/mol, respectively. The extraction rate of chromium from the leaching residue using lime-free roasting reached 98.41%, which was highly superior to the 9.85% obtained from the slag without desilication.

Key words: chromium-containing slag, desilication, kinetics, lime-free roasting.

1. Introduction

The titano-magnetite deposit in the Hongge Mine of Panzhihua City, China has a tremendous reserve of 3.55 billion tons (Zhao et al., 2014). It contains a relatively high content of chromium (0.2 to 0.8%) in addition to iron, titanium, and vanadium (Fang et al., 2012). The current technical process of the vanadiferous titano-magnetite ore is shown in Fig. 1 (Deng et al., 2007; Fu et al., 2011; Zhou et al., 2012). In the original ore, the main iron-bearing minerals contained ilmenite, magnetite concentrates and cobalt pyrite concentrates. In the first procedure of ore dressing, the magnetite concentrates with the association of vanadium and chromium are separated from other gangue minerals and transported into a blast furnace (BF). The vanadiferous hot metal is then produced through a BF flow, and most of the titanium with a formation of TiO_2 enters the steel slag. Through the blowing process, the metallic iron is produced by a reduction procedure in a rotary hearth furnace, and the vanadium remains in the steel slag. After a proposed extraction method of