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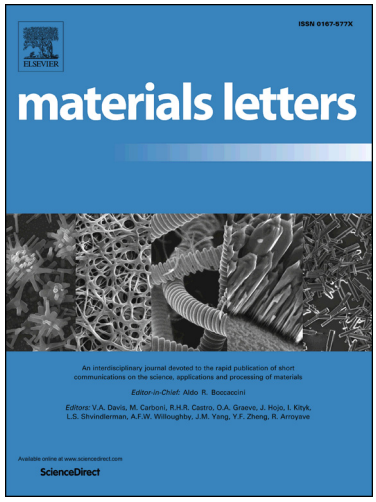

Immobilization of heavy metals (Cd, Ni or Pb) using aluminate geopolymers

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Immobilization of heavy metals (Cd, Ni or Pb) using aluminate geopolymers

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Abstract

In the present study, a waste aluminate solution from the anodizing industry was used to synthesize coal fly ash- and blast furnace slag-based geopolymers as metal-immobilizing matrixes. Different alkali-activating agents such as NaOH and sodium silicate have also been used in order to achieve defined Si/Al or Na/Al ratios in the mixtures. Mixtures of simulated waste containing hazardous metals such as Pb, Cd, or Ni with the geopolymer materials have been processed to study the potential of geopolymers as waste immobilizing agents. The effects of composition on the compressive strength and metals leachability were assessed. Of the two aluminate geopolymers studied, those containing slag exhibited better mechanical performance. Concentrations of the metals leached from the stabilized products were strongly pH dependent, showing that the leachate pH was an important variable for the immobilization of metals.

Keywords: Slag, geopolymer, fly ash, aluminum waste, hazardous metals, immobilization

1. Introduction

In this paper, geopolymerization technology has been proposed to stabilize and solidify a simulated residue containing hazardous metals such as Pb, Cd or Ni. Geopolymers are commonly obtained by the reaction between a solid aluminosilicate and a highly concentrated aqueous alkali hydroxide or silicate solution [1]. The raw materials mainly used in geopolymerization are clays or pozzolanic materials such as kaolin, calcined kaolin, different fly ashes (FA) and blast furnace slag (BFS) that partially dissolve in the alkali solution.

The alkali solution dissolves alumina and silica precursors and maybe for this reason alkaline silicates or aluminates have been proposed as activating solutions. The use of aluminates as