Abstract

Lead-zinc smelting slag (LZSS) is an industrial waste which is considered as hazardous waste due to the presence of heavy metals (Pb, Zn, Cr and Cu). These heavy metals can be leached into the ecosystem to pollute the environment. Moreover, LZSS is utilized as the preparation of alkali-activated materials (AAM) because it is rich in aluminosilicates. In order to limit its leaching toxicity, LZSS is utilized to prepare AAM and achieve self-cementation solidification of its heavy metals in the current study. LZSS based alkali-activated materials (LZAC) with excellent compressive strength (96.14 MPa) were obtained through single factor and orthogonal experiments. The factors included in these experiments are temperature, Na2O equivalent, waterglass module and water-cement ratio. The results of compressive strength and leaching experiments confirmed that LZAC could be used for construction purposes. The X-ray diffraction, Fourier transform infrared spectroscopy and Field-emission scanning electron microscopy with energy dispersive spectrometry results show that heavy metals are effectively immobilized in LZAC by chemical fixation and physical encapsulation.

Keyword: Self-cementation solidification, Lead-zinc smelting slag, Alkali-activated materials, Compressive strength, Heavy metals, Mechanism