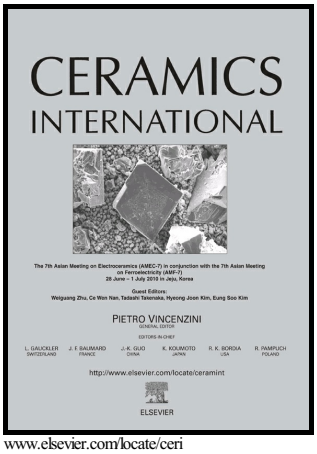

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Recycling of harmful waste lead-zinc mine tailings and fly ash for preparation of inorganic porous ceramics

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Abstract

The porous ceramics were prepared by directly sintering of lead-zinc mine tailings and fly ash as the raw materials without any additional sintering and foaming agent. The effects of fly ash addition on the crystalline phases, pore structure, physical–chemical porosities and mechanical strength were investigated. The results showed that the bulk density decreased firstly and then increased while the porosity and water absorption presented the opposite tendency with the increase of fly ash content. Meanwhile, the chemical stability improved and the flexural strength had the same variation tendency of the bulk density. The phase evolution of sample with 60 wt% fly ash addition indicated that anorthite phase was formed at low temperature (1000 °C). The thermal behavior illustrated that the foaming process was initiated by the reaction of internal constituents in the lead-zinc mine tailings. Different pore structures indicated different foaming mechanisms that probably occurred at different temperatures. The porous ceramics with 60 wt% fly ash addition exhibited excellent properties, including bulk density of 0.93 g/cm^3, porosity of 65.6%, and flexural strength of 11.9 MPa.

Keywords: Porous ceramics; Lead-zinc mine tailing; Waste; Anorthite;

1. Introduction

With the increase demand of the building materials, the natural resources are reaching critical and distressing levels. Moreover, the increase of solid wastes and environmental problem has made the recycling of wastes become a serious issue [1, 2]. To protect natural resources and relieve the pressure of the increased wastes, using solid wastes as a partial replacement of building raw materials to produce new type engineering materials can be an effective route to achieve the aforesaid target. Previously, the incorporation of wastes into ceramic bricks, concrete and ceramic tiles has been investigated and it has demonstrated the viability of reusing industrial wastes in ceramic products [3-5].

Lead-zinc mine tailings are a harmful waste generated during the production of lead and zinc. Every year, large amounts of lead-zinc mine tailings are produced and stored in the tailing pond or backfilled in