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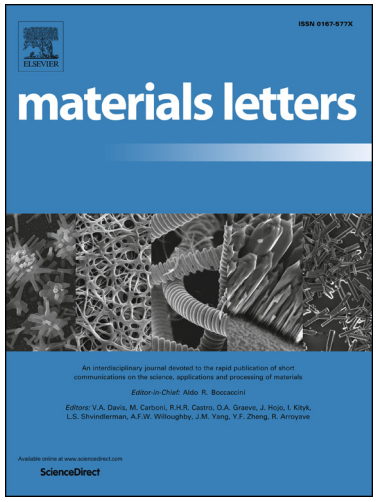

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Effect of Ca in P-doped basaltic glass-ceramics: application to waste inertization

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Abstract

A sewage sludge composition is simulated by adding CaO and P_2O_5 to a basalt in order to produce glasses with low viscosity at high temperatures. Raman spectroscopy shows the presence of Q^0 and Q^2 silicate groups. The increase of Vickers microhardness is related to an nucleation of crystalline phases (magnetite, diopside, akermanite) that crystallize upon thermal treatments. Raman spectroscopy has given information on the presence of Q^0 and Q^2 silicate groups. These new glass-ceramics may be used as starting compositions for the immobilization of other industrial wastes.

Keywords: Amorphous materials, Raman, Thermal Analysis, Viscosity, Inertization

Introduction

Environmental pollution is a major concern in modern societies [1]. Urban sewage sludge (USS) from water decontamination is a high volume and potentially hazardous waste. In Directive 86/278/EEC, the European Economic Community defines sewage sludge as any residual sludge from wastewater treatment plants [2]. The yearly production in the European Union averages at least 10 Mt [3]. The recycling of sludge as a substitute for fertilizers in agriculture is limited because of potentially high toxic metals contents [4]. Alternatives include disposal in controlled landfills and incineration treatments. Another alternative – based on a certain similarity between urban sewage sludge and basalt [5,6] – is vitrification, which provides an inert material with potential uses in the construction industry. The differences arise in MgO and SiO_2 concentrations being higher in basalt, whereas sludge are enriched in P_2O_5 and CaO.