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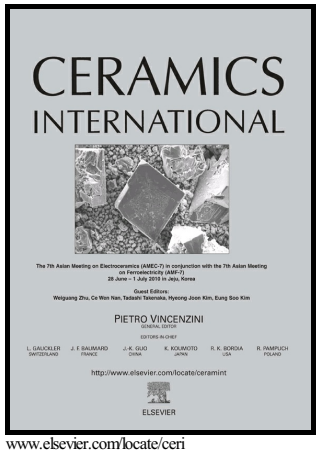

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Impact of Reactive SiO_2/Al_2O_3 Ratio in Precursor on Durability of Porous Alkali Activated Materials

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Abstract.

This study focuses on the properties of porous alkali activated materials (AAM) involving the reactive phases of the raw materials. Two types of calcined clays (illite – IC and metakaolin – WMK) and aluminium scrap recycling waste (ASRW) were considered as precursors for alkali activation. The porous AAM were obtained using ASRW with a different mass ratio in the mixture design as pore forming agent. Two types of fillers (quartz or dolomite powder) were used in AAM and evaluated. The commercial solution of sodium silicate ($Na_2SiO_3+nH_2O$) modified by alkali flakes (NaOH) was used as an activating solution. The alkali activation mechanism was investigated using FTIR and XRD. Physical, mechanical and durability properties of the obtained materials were tested. The difference of physical and mechanical properties of the porous AAM was not strongly affected by the reactive SiO_2/Al_2O_3 ratio. The density of the AAM was in the range from 550 to 675 kg/m^3 and the total porosity was from 70% to 80% depending on the composition. The compressive strength of the porous AAM was in a range from 1.4 to 2.0 MPa (IC sample series) and from 2.0 to 3.8 MPa (MWK sample series). However, the AAM with high SiO_2/Al_2O_3 ratio (1.0-2.4 for IC sample series) have poor durability while sample series with WMK (reactive SiO_2/Al_2O_3 ratio 0.7-0.8) show satisfactory results regarding to the sulphate resistance and can withstand up to 50 standard freeze-thaw cycles.

Keywords: Illite, Metakaolin, Reactive Phase, Alkali Activation, Porous Building Material, Durability

Introduction

Alkali-activated materials (AAM) receive increasing attention as an alternative to Portland cement based materials because of their high strength and durability and low environmental impact. AAM are traditionally made by mixing solid aluminosilicate powders, such as fly ash, blast furnace slag, metakaolin or others, with alkaline activating solutions, and fillers [1]. The solid aluminosilicate