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Physico-mechanical and microstructural evolution of sintered pressed geopolymer: Dual effects of aging period and sintering temperature

Abstract

Ceramics are highly valued for their exceptional thermal resistance and ability to withstand high temperatures. This study investigated the production of ceramic-like pressed geopolymer, focusing on the effects of aging period and sintering temperature. The results showed that the 7-day pressed geopolymer achieved the highest compressive (134.7 MPa) and flexural (34.9 MPa) strengths after sintering at 1000°C, with a density retention of 93.7 %, a mass loss of 7.9 %, and a thermal shrinkage of 1.4 %. Microstructural analysis at 1000°C showed a dense ceramic-like structure with nepheline formation. Phase analysis of the 7-day pressed geopolymer revealed a decrease in the amorphous phase as temperature increased, with nepheline formed at 800°C (26.0 %) and maximized at 1000°C (61.0 %). This work offers an optimal aging period and sintering temperature to maximize the mechanical strength and nepheline crystal formation, making them perfect for fire-resistant panels and precast construction products.

Keywords

Aging; Cold pressing; Geopolymer; Phase evolution; Sintering temperature