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Abstract:

In this research, the impact of Al₂O₃ nanoparticles addition on microstructure, mechanical, and physical properties of bauxite self-flowing low-cement castables were investigated. Also, the optimum amount of Al₂O₃ nanoparticles is determined. For this propose, up to 3 wt. % Al₂O₃ nanoparticles were added to the bauxite castable compositions. The physical and mechanical properties of castable compositions such as bulk density (BD), apparent porosity (AP), self-flow values (SFV), and cold crushing strength (CCS) were examined. Also, the X-ray diffraction (XRD) and scanning electron microscopy (SEM/EDX) techniques were used for detection the ceramic phase's formation and microstructural analysis of the castables compositions, respectively. Results show that addition of Al₂O₃ nanoparticles up to 1wt. % improved the properties of bauxite self-flowing low-cement castables. As well as, the use of Al₂O₃ nanoparticles led to the formation of the platy and needle crystalline phases such as hibonite (CaO·6Al₂O₃), calcium dialuminate (CaO·2Al₂O₃), and mullite (3Al₂O₃·2SiO₂), between the grain boundaries of the bauxite particles. Also, Al₂O₃ nanoparticles addition led to aforementioned phase formation occur at the lower temperatures.

Keywords: Al₂O₃ nanoparticles, self-flowing, castables, hibonite, mullite.

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