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The Effect of Adding Microsilica on the Rheological Behavior and Injectability of the Paste in the Injection Molding of Silica-Based Ceramic Cores

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Abstract : Microsilica (silica foam) is a byproduct of ferrosilicon production and silicon metal. Microsilica particles have a spherical shape, an average diameter of 0.15 µm, and a specific surface area of 15-25 m^2. g^{-1}. The overall density of this material is 150-700 $kg.m^{-3}$. Many researchers have investigated the effect of adding microsilica on the flow properties of cement mixtures. This paper investigated the effect of adding microsilica on the flow behavior and injectability of silica-based paste. For this purpose, different percentages of microsilica have been used to prepare the paste. The rheometric test was performed on all the samples with different percentages of microsilica additives using an MCR300 rotary viscometer at a temperature of 70°C. In addition, the ability to inject pastes containing different amounts of microsilica at pressures of 25, 40, 50, and (bar) 60 at constant temperature and flow in a mold with dimensions of 80 × 80 × 0.5 mm^3 has been investigated. Then, the effect of microsilica addition on the strength, porosity percentage, and leachability of the sintered core was studied. The results show that the rheological behavior of the paste is pseudoplastic; also, the silane index decreases with the increase in the percentage of microsilica addition, and the viscosity increases. On the other hand, the addition of microsilica has led to the appearance of thixotropic in the paste. By increasing the amount of microsilica, the injectability has significantly improved at low pressures. The strength of the sintered core increases with the increase of microsilica and the amount of remaining porosity and leachability decreases.

Keywords : microsilica, rheological behavior, injectability, injection molding, silica-based ceramic cores, leachability
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