Effect of Agitation on Crystallization and Rheological Behavior of Super-cooled Calcium Silicate Based Melts Characterized by Electrical Capacitance Measurement

Noritaka Saito [C, S] and Kunihiko Nakashima
Department of Materials Science and Engineering, Kyushu University, Fukuoka, Japan
saito@zaiko.kyushu-u.ac.jp

The effect of agitation on the crystallization behavior of super-cooled calcium silicate melts were systematically investigated by the measurement of their electrical capacitance over a wide temperature range from liquid region to well below the liquidus temperature. It is well known that the electrical capacitance of liquids is generally much higher than that of solids owing to the differences in their respective polarization mechanisms. These differences were exploited as a sensitive indicator of the crystallization of molten calcium silicates in an experimental furnace equipped with an electrical capacitance measuring system. The system comprised a Pt-based alloy crucible and a rotating rod that allowed evaluation of the effect of agitation generated by the rod, connected to a capacitance meter. As expected, at a particular temperature, the electrical capacitance of the molten calcium silicates underwent a precipitous decrease by roughly three orders of magnitude, which was dependent on the chemical composition. This indicated the presence of crystallization and this was confirmed by corresponding microstructural characterization. It was also found that, for the measurements acquired with rotating rod agitation, the temperatures at which the capacitance underwent the sharp decrease were higher than that identified without the agitation. This suggests that the agitation effect induced by the rotating rod accelerates the crystallization of molten calcium silicates. Additionally, variation in the apparent viscosity of the super-cooled calcium silicate melts with dispersed crystalline phases will be discussed at the symposium.