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Structure-viscosity relationship in mold fluxes using spectroscopy techniques

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Mold fluxes are complex oxides that, due to their chemical composition and structure, can be classified as glass-ceramics. These materials are used as lubricants in the continuous casting of steels. The rheology of these multicomponent oxide systems, at temperatures between 1200-1400°C, plays a fundamental role during the process, since the viscosity in the mold wall has to be adequate to maximize the lubrication capacity. For this reason, it is of technological interest to understand the relationship between this macroscopic property and the molecular/ionic structure, which strongly affects the performance of these materials in metallurgical processes.

In this work, glassy layers of three commercial mold fluxes were obtained by quenching from 1300°C. These layers were characterized by XRD, Raman and XPS spectroscopy. The viscosity of these materials, measured between 1250-1350°C, were associated with a polymerization index of the silicate networks determined by the deconvolution of the Raman peak between 800-1200 cm-1. The higher content of sodium (Na) and fluorine (F), forming Si-O-Me links (Me = F, Na) it is associated to a lower activation energy of viscous flow. From the analysis of XPS spectra it is proposed that, in addition to Si-O-Na, other species such as Si-O-Ca-F are formed.

Biography

Edgardo Benavidez received his doctorate in Physics from the National University of Rosario (Argentina). He entered the National Technological University (UTN) in 1998, where he became a professor of Materials Science in 2010. He is currently Director of the Materials Development and Technology Center (DEYTEMA) and Deputy Director of the Research and Transfer Center (CIT-San Nicolás). His research expertise includes: (1) Traditional and advanced ceramic materials: fabrication and characterization techniques, (2) Refractory materials: evaluation of mechanical properties and corrosion by metallurgical slags, and (3) Characterization of physicochemical properties of steelmaking slags.

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