Measurement of Oxygen Potential of Stainless Steel Slags with a Pt Electrode-Based Sensor Prepared by MOCVD

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A sensor employing yttria-stabilized zirconia (YSZ) was used to determine the oxygen potential of slags based on the CaO-SiO$_2$-CaF$_2$-CrO$_x$-Al$_2$O$_3$ system at 1723 K. The YSZ sensors were coated with Pt electrode films deposited by metal-organic chemical vapor deposition (MOCVD) to increase the conductivity of the measuring devices and to decrease their response time. The oxygen potential of the slags was related to the $a_{\text{CrO}}/a_{\text{CrO1.5}}$ ratio through the Nernst equation and the free energy of the equilibrium reaction between CrO and Cr$_2$O$_3$. Good agreement was obtained between the measured values and the theoretically calculated results. The order of magnitude of $a_{\text{CrO}}/a_{\text{CrO1.5}}$ was too low, between 0.0005 and 0.005, owing mainly to the high oxidation conditions that prevail in an open induction furnace. It was also found that $a_{\text{CrO}}/a_{\text{CrO1.5}}$ slightly decreases with an increase in the amount of Al$_2$O$_3$ in the system.

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