Recycling of Chromium-Containing Waste Oxide as Alloying Addition in Ladle Metallurgy: kinetics modeling through FactSage Macros

Shengqiang Song[†,‡], Dai Tang[‡], Deepoo Kumar[‡,§], Petrus Christiaan Pistorius[‡,*]

[†] The State Key Laboratory of Refractories & Metallurgy, Wuhan University of Science and Technology, Wuhan 430081, China
[‡] Center for Iron and Steelmaking Research, Department of Materials Science & Engineering, Carnegie Mellon University, Pittsburgh, PA 15213, USA
[§] Department of Metallurgical Engineering and Materials Science, IIT Bombay Powai, Mumbai, 400076, India

Recycling of chromium-containing waste oxide (from spent catalyst) in ladle metallurgy would both dispose of hazardous waste and save alloying cost. While reduction of chromium oxide from the slag is thermodynamically feasible, successful recovery of chromium would depend on the kinetics of chromium reduction. A laboratory slag-steel reaction experiment was conducted, adding chromium oxide to a simulated ladle slag. The rapid kinetics indicates that emulsification of the slag-metal interface occurred. Evolution of the oxide inclusions in the steel was unaffected by reduction of chromium oxide; the inclusions followed the sequence from alumina to spinel to periclase as in other aluminum-killed steels.