Towards Modelling of Slag Entrainment in Gas Stirred Ladles by LES

HUANG Ao

Ceramics,
Montanuniversitaet Leoben,
Austria

The Large eddy simulation (LES) has been shown to be a promising modelling approach to the prevailing turbulent flow conditions which implicate the risk of entrainment of slag droplets into the molten steel particularly with regard to refractory wear. But this simulation proves to be very challenging as multi scale phenomena occur. Especially the droplet size and the large eddy simulation (LES) approach applied necessitate meshing with a rather small cell size. Therefore, an analytical framework was set up to describe the fluid dynamics of the gas – liquid plume, the spout and the slag eye opening and to identify the boundary conditions for a reduced domain of the gas stirred ladle, so that LES is possible. LES in combination with a multiphase volume of fluid (VOF) model of the stratified liquids metal and slag were applied. Preliminary 2D LES simulations were performed. The simulation shows the slag entrainment mechanism: An amount of slag is pulled toward the molten steel and droplets were detached at its lower end. The size and the distribution of the slag droplets change with increasing gas flow rate; up- and downwards moving droplets will probably contact the refractory wall if the gas flow rate reaches or exceeds a critical value which was revealed in an example study.

Co-authors: **Sandra Vollmann, Harald Harmuth**