Guillaume BROSSE

ArcelorMittal Global Research and Development,
Maizières-Lès-Metz,
France

When operating a top-blowing BOF converter, the depth of the cavity formed in the molten bath by the oxygen jet is an important criterion to define practical blowing patterns (lance height and oxygen flow rate during the heat) and adapt them to changing industrial conditions (lining age, new lance design…). Gas jet penetrability is directly related to jet momentum and is influenced by many factors such as the distance between nozzle and bath, oxygen flow rate and nozzle geometry.

Several correlations giving penetration depth of an impinging gas jet can be found in the literature and are usually based either on a force balance or are fitted from experimental measurements. Most of these correlations were validated with cold water models. However, in an industrial BOF, the jet is supersonic and high temperatures lead to higher axial velocity compared to expansion in room temperature surroundings. Therefore, the application of the correlations to study penetrability of an impinging oxygen jet in a converter is not straightforward.

A comprehensive comparison of the theories was performed to improve the available correlations while correctly taking into account the influence of hot surroundings and jet compressibility. In parallel, CFD calculations were conducted to study the supersonic jet behaviour and its interaction with the free metal surface. Mean cavity depth from theoretical and experimental formulas as well as CFD modelling was compared to the new improved correlations with consistent results.

This study resulted in a better understanding of jet impacts and their sensitivity to blowing conditions, in particular in hot surroundings. This was used to set-up improved blowing practices at some of ArcelorMittal's BOF converters to enhance reaction control in the furnace during the blow.

Co-authors: **Ghassan Ghazal, Jean-Christophe Huber**