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Numerical simulation of interaction during the top blow in a steel-making converter. (English) Zbl 1227.80047

Int. J. Heat Mass Transfer 54, No. 19-20, 4275-4279 (2011).

Summary: The numerical modeling of interaction between oxygen high-pressure jets and a liquid – metal surface in a steel-making converter, where, under the force action of the jets, a cavern with a hydrodynamically unstable surface forms in the metal bulk, is studied. A simplified scheme of chemical reactions and mechanisms of metal-drop dispersing from the interface between the phases is proposed. This scheme permits an adequate description of the hydrodynamic flow pattern in the cavern. The modeling of a two-phase turbulent flow in the cavern is considered within the framework of the continuum model based on the averaged Navier – Stokes equations. To close the equations, a modified $k-\varepsilon$ turbulence model is used, which takes into account the presence of the second phase. The flow structure in the cavern is studied. Practical recommendations for increasing the efficiency of the carbon-monoxide afterburning process in the cavern are given.

MSC:

80A25 Combustion
80A32 Chemically reacting flows
76D05 Navier-Stokes equations for incompressible viscous fluids
76F60 k-ε modeling in turbulence
76J20 Supersonic flows
76H05 Transonic flows
76T10 Liquid-gas two-phase flows, bubbly flows
35Q30 Navier-Stokes equations

Keywords:

numerical modeling; interaction; turbulent flow; Navier-Stokes; flow structure

Full Text: DOI

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