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Rise of an argon bubble in liquid steel in the presence of a transverse magnetic field SURYA PRATAP VANKA, KAI JIN, PURUSHOTAM KUMAR, BRIAN THOMAS, University of Illinois at Urbana-Champaign — In this work, the motion of a single argon gas bubble rising in quiescent liquid steel under an external magnetic field is studied numerically using a Volume-of-Fluid (VOF) method. To mitigate spurious velocities normally generated during numerical simulation of multiphase flows with large density differences, an improved algorithm for surface tension modeling, originally proposed by Wang and Tong [International Journal of Thermal Sciences 47, 221–228 (2008)] is implemented, validated and used in present computations. The governing equations are integrated by a second-order space and time accurate numerical scheme, and implemented on multiple Graphics Processing Units (GPU) with high parallel efficiency. The motion and the terminal velocities of the rising bubble under different magnetic fields are compared and a reduction in rise velocity is seen in cases with the magnetic field applied. The shape deformation and the path of the bubble are discussed. An elongation of the bubble along the field direction is seen, and the physics behind these phenomena is discussed. The circulation inside of the bubble is seen to be affected by the magnetic field indirectly. The wake structures behind the bubble are visualized and effects of the magnetic field on the wake structures are presented.

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