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Falling Film Flow of Slag LING MIAO, WEI-TAO WU, Department of Mechanical Engineering, Carnegie Mellon University, NADINE AUBRY, Department of Mechanical Engineering, Northeastern University, MEHRDAD MASSOUDI, U.S. Department of Energy, National Energy Technology Laboratory — In this paper, numerical calculations have been performed to study the heat transfer in the fully developed flow of a slag layer down a vertical wall. A new constitutive relation for the stress tensor of the slag is proposed, where the viscosity depends on the volume fraction, temperature, and shear rate. For the heat flux vector, we assume the Fourier's law of conduction with a constant thermal conductivity. The model is also capable of exhibiting normal-stress effects. The effects of various dimensionless numbers on the velocity, temperature and volume fraction are examined by numerically solving the governing equations. We also compared the different cases of shear thinning and shear thickening, cooling and heating. The effect of the exponent in the Reynolds viscosity model is also discussed. The results indicate that the viscous dissipation and radiation (at the free surface) cause the temperature to be higher inside the flow domain.

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