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# A thermodynamically consistent and conservative diffuse-interface model for two-phase flows in complex geometries

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In this work, a thermodynamically consistent and conservative diffuse-interface model for gas-liquid-solid multiphase flows is proposed. In this model, a novel free energy for the gas-liquid-solid multiphase flows is established according to a ternary phase-field model, and it not only contains the standard bulk and interface free energies for two-phase flows, but also includes some additional terms to reflect the penalty in the solid phase and the wettability on the solid surface. Furthermore, a smooth indicator function of the solid phase is also introduced in the consistent Navier-Stokes equations to achieve a high viscosity in the solid phase and preserve the velocity boundary conditions on the solid surface. Based on the proposed diffuse-interface model, the fluid interface dynamics, the fluid-structure interaction, and the wetting property of the solid surface can be described simply and efficiently. Additionally, the total energy is also proved to be dissipative for the two-phase flows in the stationary geometries. To test the present diffuse-interface model, we develop a consistent and conservative lattice Boltzmann method and conduct some simulations. The numerical results also confirm the energy dissipation and good capability of the proposed diffuse-interface model in the study of two-phase flows in complex geometries.

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References

### **Conference Proceedings**

**Primary authors:** ZHAN, Chengjie (Huazhong University of Science and Technology); Dr LIU, Xi (Huazhong University of Science and Technology); Prof. CHAI, Zhenhua (Huazhong University of Science and Technology)

**Presenter:** ZHAN, Chengjie (Huazhong University of Science and Technology)

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