A moment of fluid method for computing solutions to multiphase/multimaterial flows

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We combine the multimaterial Moment-of-Fluid (MOF) work of Ahn and Shashkov with the work of Kwatra et al for removing the acoustic time step restriction in order to solve multimaterial flows in which each material might be compressible or incompressible. The mass weights found in the algorithm of Kwatra et al are computed directly from the multimaterial MOF reconstructed interface. We treat the interface(s) between materials as sharp when discretizing the boundary conditions between materials. The combination of the multimaterial MOF reconstruction together with the cell centered formulation devised by Kwatra et al enable us to robustly compute multimaterial flows with large density ratios, stretching and tearing of interfaces and contact line dynamics at the junction of 3 materials with minimal volume fluctuation of each material (if a given material is incompressible). Simulations for multimaterial flows are presented with applications to combustion (atomization and spray) and microfluidics.