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A Numerical study of ablative flow driven by thermodynamics and kinetics[1] RYAN CROCKER, YVES DUBIEF, University of Vermont, CHRISTOPHER WHITE, University of New Hampshire — The main focus of this research is to elucidate the relationship between ablative/erosive flows and their interaction with a spatially dynamic boundary conditions. The fluid-solid interface is described by a level-set (LS) approach, enabling efficient and accurate computation of wall-normal vectors and other geometrical properties. Boundary conditions at the interface are imposed using immersed boundary methods (IBM). Our LS/IBM ablation algorithm is able to simulate various ablation processes, in particular ablation by chemical reactions and phase-change. The momentum boundary conditions are handled through cut cell IBM applied implicitly. This method is fully mass conserving and eliminates issues with spurious pressure oscillations. Scalar boundary conditions are simulated with a form of the ghost fluid method, with known thermal and chemical physics, to interpolate values across the fluid/solid interface after they are decoupled. We will discuss two applications of this algorithm. The first is the simulation of an experiment of the oxidation of a carbon material at around 1000K conducted at NASA AMES. The second focuses on the interactions between heated wall-turbulence and a low-melting point material in collaboration with parallel experiments at University of New Hampshire.

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