Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Dynamic evolution of a flow to localized, kinetics-driven ablation or coagulation[1] DANIEL HAGAN, RYAN CROCKER, YVES DUBIEF, University of Vermont — This research focuses on the numerical simulation of the ablative creation of a cavity or a coagulative formation at a wall in a flow. The fluid-solid interface is defined by a level set (LS) variable, whose transport equation is driven by the mass-loss or growth process. The boundary conditions at the fluid-solid interface are enforced by a mass and energy-conserving immersed boundary method (IBM) using the ghost-fluid node approach for the latter and for the transport of chemical species. The first application of the LS/IBM algorithm is a channel flow in which both walls are cavity-free, but one wall contains a section made of ablatable material, which could correspond to a hole or gap in a spacecraft thermal protection shield. The second application is a pipe flow in which the wall is capable of accumulating material, which could describe the coagulation of blood at a vessel wall. The solid mass loss or growth is driven by one step kinetics. For both flows, the dynamical interplay between the ablative or coagulative patch is investigated through statistics and flow topology.

[1]We gratefully acknowledge the financial support of NASA, grant No. NNX11AM07A, and NIH, grant No. P01HL46703, and the computational support of the Vermont Advanced Computing Core.

Daniel Hagan
University of Vermont

Date submitted: 02 Aug 2012 Electronic form version 1.4