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Turbulent non-premixed combustion driven by the Richtmyer-Meshkov instability HILDA VARSHOCHI, PRAVEEN RAMAPRABHU, NITESH ATTAL, University of North Carolina at Charlotte — We report on 3D high resolution numerical simulations of a non-premixed, reacting Richmyer-Meshkov (RM) instability performed using the FLASH code. In the simulations, a Mach 1.6 shock traverses a diffuse, corrugated material interface separating Hydrogen at 1000 K and Oxygen at 300 K, so that local misalignments between pressure and density gradients induce baroclinic vorticity at the contact line. The vorticity deposition drives the RM instability, which in turn results in combustion and flame formation. We study the evolution of the interface and the flame as the resulting RM instability grows through linear, nonlinear and turbulent stages. We develop a detailed understanding of the effects of heat release and combustion on the underlying flow properties by comparing our results with a baseline non-reacting RM flow. We document the properties of the instability (growth rates, pdfs, spectra) and the flame (scalar dissipation rate, flame surface area, heat release rate) as well as the nature of the coupling between the two. Our findings are relevant to supernovae detonation, knocking in IC engines and scramjet performance, while the underlying flow problem defined here represents a novel canonical framework to understand the broader class of non-premixed turbulent flames.

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