Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Entrainment in a Reacting Compressible Shear Layer CYRUS K. MADNIA, REZA JAHANBAKHSHI, SUNY at Buffalo — DNS of reacting turbulent shear layer is performed to study the entrainment of the irrotational flow into the turbulent region. The effects of heat release and compressibility on the flow are examined. Infinitely fast chemistry approximation is used to model the one-step global reaction of hydrogen in air. Entrainment is studied via two mechanisms; nibbling, considered as the vorticity diffusion across the turbulent/non-turbulent interface, and engulfment, the drawing of the pockets of the outside irrotational fluid into the turbulent region. As the level of compressibility or heat release increases, the total entrained mass flow rate into the shear layer decreases. It is observed that nibbling is a viscous dominated mechanism in non-reacting cases, whereas it is essentially inviscid in reacting flows with high heat release level. It is shown that the contribution of the engulfment to entrainment is small for the non-reacting flows, while mass flow rate due to engulfment can constitute up to forty percent of total entrainment in reacting cases. This increase is primarily related to a decrease of mass flow rate due to nibbling while the mass flow rate due to engulfment does not change significantly in reacting cases.

Cyrus K. Madnia
SUNY at Buffalo

Date submitted: 28 Jul 2016 Electronic form version 1.4