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Viscous Superlayer in a Reacting Turbulent Mixing Layer CYRUS K. MADNIA, SUNY at Buffalo, REZA JAHANBAKHSHI, Johns Hopkins University — Direct numerical simulations (DNS) of reacting compressible shear layer have been performed to study some characteristics of the viscous superlayer (VSL). The VSL forms the outer sublayer of the turbulent/non-turbulent interface (TNTI), and is responsible for the transfer of vorticity from the high vorticity regions inside the turbulent region into the irrotational region by viscous diffusion. Budgets of the transport equation of enstrophy conditioned on the normal distance from the TNTI is used to define and detect the VSL. It is observed that in reacting and non-reacting compressible shear layers of current study, the conditional averages of the viscous diffusion and viscous dissipation terms start to deviate from zero slightly outside of turbulent region, whereas, the conditional averages of the other terms start to deviate from zero right at the interface. This is an indication of the presence of a viscous superlayer. A new method is used to find the thickness of the VSL. It is shown that while compressibility seems to have a small effect on the thickness of the VSL in the non-reacting cases, as the level of heat release increases the thickness of this layer decreases in reacting cases.

> Cyrus Madnia SUNY at Buffalo

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