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Stability of high-speed boundary layers in oxygen including chemical non-equilibrium effects[1] JILL KLENTZMAN, ANATOLI TUMIN, University of Arizona — The stability of high-speed boundary layers in chemical non-equilibrium is examined. A parametric study varying the edge temperature and the wall conditions is conducted for boundary layers in oxygen. The edge Mach number and enthalpy ranges considered are relevant to the flight conditions of reusable hypersonic cruise vehicles. Both viscous and inviscid stability formulations are used and the results compared to gain insight into the effects of viscosity and thermal conductivity on the stability. It is found that viscous effects have a strong impact on the temperature and mass fraction perturbations in the critical layer and in the viscous sublayer near the wall. Outside of these areas, the perturbations closely match in the viscous and inviscid models. The impact of chemical non-equilibrium on the stability is investigated by analyzing the effects of the chemical source term in the stability equations. The chemical source term is found to influence the growth rate of the second Mack mode instability but not have much of an effect on the mass fraction eigenfunction for the flow parameters considered.

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