Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

The effect of chemistry and transport models on the inviscid stability of boundary layers in binary mixtures of oxygen and nitrogen[1]
ERMAN ULKER, JILL KLENTZMAN, ANATOLI TUMIN, University of Arizona
— An inviscid stability analysis of boundary layers in binary mixtures of oxygen and nitrogen in chemical non-equilibrium is conducted. Cold and adiabatic, non-catalytic walls are considered and two different chemistry and transport models are used: the reaction rates and transport models of Gupta et al. (1990) as well as Blottner's transport model (1971) with Park's reaction rates (1989). The results show that changing the chemistry and transport models has a major impact on the boundary layer profiles and the perturbation growth rates when dissociation is significant in the boundary layer. In the model of Gupta et al., the reaction rates do not change with respect to the collision partner in binary mixtures of oxygen, which is in contrast to Park's reaction rates. For binary mixtures of nitrogen, the reaction rates change according to the collision partner for both models. The results of the comparison of different chemistry and transport models show that the flow in binary mixtures of oxygen is more affected by the choice of the model than in binary mixtures of nitrogen.

[1]This work was supported by the AFOSR/NASA/National Center for Hypersonic Research in Laminar-Turbulent Transition.

Jill Klentzman
University of Arizona

Date submitted: 11 Aug 2011 Electronic form version 1.4