

Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Direct Numerical Simulation Study of Nonequilibrium Effects on Mixing and Combustion in Supersonic Jets HEESEOK KOO, Flight Vehicle Research Center, Seoul National University, VENKAT RAMAN, PHILIP L. VARGHESE, Dept. of Aerospace Engineering and Engineering Mechanics, University of Texas at Austin — Thermochemical nonequilibrium could be significant in scramjet engines due to intense shock-based compression in the pre-combustion isolator region. In particular, vibrational nonequilibrium could adversely affect ignition time and mixing efficiency. To understand the role of nonequilibrium in such flows, direct numerical simulation (DNS) of supersonic flows with vibrational excitation are studied. A linear time-scale model is used to describe the vibrational relaxation of excited species. Essentially, nonequilibrium alters the flow by changing the physical properties that are related to the translational temperature. Such changes introduce nonlinear effect on the scalar mixing process. Further, the redistribution of energy amongst the internal states affects chemical rates. An analysis of the impact of nonequilibrium on combustion is provided.

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Date submitted: 02 Aug 2013

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