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Model Scramjet Inlet Unstart Induced by Mass Addition and Heat Release SEONG-KYUN IM, Worcester Polytechnic Institute, DAMIANO BACCARELLA, BRENDAN MCGANN, QILI LIU, University of Notre Dame, LYDIY WERMER, Worcester Polytechnic Institute, HYUNGROK DO, Seoul National University — The inlet unstart phenomena in a model scramjet are investigated at an arc-heated hypersonic wind tunnel. The unstart induced by nitrogen or ethylene jets at low or high enthalpy Mach 4.5 freestream flow conditions are compared. The jet injection pressurizes the downstream flow by mass addition and flow blockage. In case of the ethylene jet injection, heat release from combustion increases the back-pressure further. Time-resolved schlieren imaging is performed at the jet and the lip of the model inlet to visualize the flow features during unstart. High frequency pressure measurements are used to provide information on pressure fluctuation at the scramjet wall. In both of the mass and heat release driven unstart cases, it is observed that there are similar flow transient and quasi-steady behaviors of unstart shockwave system during the unstart processes. Combustion driven unstart induces severe oscillatory flow motions of the jet and the unstart shock at the lip of the scramjet inlet after the completion of the unstart process, while the unstarted flow induced by solely mass addition remains relatively steady. The discrepancies between the processes of mass and heat release driven unstart are explained by flow choking mechanism.

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