TECHNIQUES FOR VENTING TRS GAS AND SMOKE FROM SHOCK TUBES

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Thermal radiation simulator (TRS) units burn aluminum in oxygen can be used inside shock tubes for combined thermal and blast simulations. Adequate thermal radiation can be assured by installing the TRS adjacent to the target.However, operating a TRS inside shock tube generates a sizeable volume of hot gases and smoke. In addition to being visually opaque, the heated gas and smoke create an acoustic discontinuity for the oncoming shock front.

A technique for dealing with hot gas and smoke from a TRS unit in a shock tube is to reduce the TRS flame dimensions and materials while providing high-capacity ventilation during the burn. Ideally, the hot gas and smoke from the burn can be ejected from the shock tube as rapidly as they are evolved by the TRS. After extensive study, the authors determined that a gas ejector showed the least sensitivity to inlet gas temperature, composition and solid content. Also the gas ejector could be expected to survive periodic exposures to TRS flame temperatures of 3200 K.

This paper describes the design and testing of a TRS burner design which reduces the amount of debris introduced into a shock tube and the design and testing of a variable geometry gas ejector system for venting TRS hot gas and smoke from a model shock tube. Experiment were performed with the SAI-TRS and the nozzle system to determine flame dimensions and debris concentrations. Experiments with the ejector were performed to determine its efficiency; to ascertain ejector tested had a 0.2 m inlet, and was
mounted on a shock tube of 0.8 m diameter and 12 m length.

Results from the test indicated that the ejector vented the tube at rates consisted with calculated expectations. The TRS nozzle system reduced the amount of TRS material required to create an appropriate radiant field. The efficiency, relating vented volume to drive flow, was within practical limits. Overall, the results appear to justify further development of ejector systems for venting shock tubes.