

SPACE PROPULSION SYMPOSIUM (C4)  
New Missions Enabled by New Propulsion Technology and Systems (6)

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EXPERIMENTAL STUDY ON THE FLOW PROCESS AND FLOW CHARACTERISTICS OF A  
BUBBLE ATOMIZING INJECTOR USING NITROUS OXIDE**Abstract**

A kind of injector using the propellant nitrous oxide and toluene was designed and experimentally investigated in this paper, while the actuating medium streamed through the ring-split and circular hole respectively. Due to the nitrous oxide's property of easy boiloff, experiments were carried out with air-water two-phase flow replacing nitrous oxide. The main focus is on the discharge characteristic of two-phase flow flowing in the ring-split. Experiments for two-phase flow conditions covered the air-to-liquid mass flow rate ratio ( $X_x$ ) range of 0.01-0.2. The research indicated that the stratified-flow model was better suited to depicting and explaining the injectors' flow characteristics than the mixed-flow model, because the mass flow coefficient calculated by the former is almost completely depend on  $X_x$ . It was also found that, by many repetitive experiments, there was a critical value of air-to-liquid mass flow rate ratio ( $X_{cr}$ ) which makes the corresponding mass flow coefficient achieving minimal value about 0.03. Analyzing the data the author concluded  $X=X_{cr}$  was possibly the turning point from the bubble flow pattern to the slug pattern within the injector. The author also validated the conclusion by studying the upstream pressure fluctuation of the injector.