Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Experimental analysis of diffuser terminal shock motion and associated acoustics in vacuum objective supersonic air ejectors[1]
JESSE MORALES, DEEPANSHI SISODIYA, JOSHUA BRINKERHOFF, SINA KHEIRKHAH, University of British Columbia Okanagan — Diffuser shock motion in vacuum objective ejectors is problematic for many industries due to excessive noise generation. This experimental study characterizes the terminal shock motion through simultaneous schlieren and wall pressure measurements in a rectangular ejector. The primary flow is driven by stagnation pressures ranging from 2.0 to 8.0 bar. Experiments are performed for both zero and non-zero suction flow rates. Low frequency oscillations are shown to have a strong correlation with upstream instability near the primary nozzle due to the combination of mixing layer instabilities and secondary stream static pressure fluctuations during restricted suction flow conditions. Various iterations of wall geometry modifications are tested using the experimental apparatus in tandem with CFD simulations to reduce the strength of this terminal shock. Increasing the mixing chamber length and bore diameter is shown to dramatically reduce shock motion in the diffuser, though motion remains more pronounced in the zero secondary flow case. Additionally, small protrusions near the diffuser entrance stabilize the terminal shock location further upstream, which reduces the generated noise.

[1]This work is financially supported by NSERCs Collaborative Research and Development grant and IVAC.

Jesse Morales
University of British Columbia Okanagan

Date submitted: 03 Aug 2020 Electronic form version 1.4