## **CEC-ICMC 2019 - Abstracts, Timetable and Presentations**



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## C3Or2C-05: Experimental performance of a Catalyzed Vortex Tube with Cryogenic Hydrogen

Wednesday 24 July 2019 15:00 (15 minutes)

Reducing liquid hydrogen boiloff from storage tanks is a key challenge facing the nascent hydrogen vehicle economy in addition to extended mission space-stage vehicles. However, the extreme cryogenic environment of liquid hydrogen necessitates novel refrigeration methods with components engineered for high-reliability. This paper presents initial experimental results of a Heisenberg Vortex Tube for cryogenic hydrogen cooling. The Heisenberg Vortex Tube is a modification of a conventional counter-flow vortex tube to incorporate a catalytic liner for parahydrogen-orthohydrogen conversion. Similar catalyzed and non-catalyzed vortex tubes are operated with pressure ratios up to 4, mass flow rates near 160 mg/s, and temperatures between 30-50 K. Experimental results demonstrate significant endothermic parahydrogen-orthohydrogen conversion as a function of cryogenic temperatures. Comparisons are made to 1st order models from literature as well as the predicted performance of a Joule-Thomson (J-T) expander operating under the same conditions. The results indicate a favorable drop-in replacement for conventional J-T expanders used in cryogenic liquid hydrogen applications.

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