Contribution ID: **100** Type: **Poster**

C1Po1B-04: Development of Conformable Cryogenic Valve Seats for Resilience to Foreign Object Debris

Monday 10 July 2023 09:15 (1h 45m)

Abstract. Cryogenic valve sealing technology is notoriously more challenging than traditional fluids due to the combination of small atoms and molecules with extreme temperature and pressure profiles. Recently, flexible polymeric films folded into origami demonstrated considerable resilience to mechanical failure in the cryogenic extreme. Showing that thin, fluorinated polymers such as Polytetrafluoroethylene (PTFE) are observed to not plastically deform in cryogenic conditions when compared to thick geometries. This paper explores a new cryogenic valve sealing paradigm which uses multiple conformable polymer layers to provide constant seat mating surface area at cryogenic conditions. Stacking these thin discs in series with a spacer allows maximum bend around the seat while creating multiple sealing surfaces. A theoretical model of thin shell deformation is developed to determine likely failure mechanisms and utilized for valve design. Experimental measurements of leakage rates with and without the presence of Foreign Object Debris (FOD) are compared with traditional re-closable pressure relief valves. Conformable cryogenic valve seats have the potential to be more repeatable, decrease leakage rates due to coefficient of thermal expansion, hysteresis, and FOD when compared to traditional market valves.

Author: Mr WOOD, Michael (Washington State University)

Co-author: Prof. LEACHMAN, J. (Washington State University)

Presenter: Mr WOOD, Michael (Washington State University)

Session Classification: C1Po1B: Components I: Valves