Contribution ID: **261** Type: **Contributed Oral**

M3Or2D-02: Preliminary Experimental Studies into the Storage Capacity of Cryogenic Hydrogen in Aerogel Blanket Materials

Wednesday 12 July 2023 11:15 (15 minutes)

The abundance and diversity of end-use applications for hydrogen necessitates continued and accelerated research into advanced storage technologies. Traditionally, hydrogen has been stored in one of two ways: as a high-pressure, warm gas; or a low-pressure, cryogenic liquid. Methods such as cryo-supercritical (i.e. cryo-compressed) and cryo-adsorbed have also been explored, but are not yet mainstream. Cryo-adsorbed is attractive in that, depending on the adsorbent and storage conditions, higher storage densities at higher temperatures than liquid can be achieved. Recently NASA, in partnership with Eta Space, Southwest Research Institute, the University of Central Florida, and Air Liquide, have been exploring the use of inexpensive, commercially available silica aerogel blanket materials in cryo-adsorbed hydrogen storage applications. Unlike most adsorbents, aerogel blanket is not a powder, but a robust, composite material that can be formed into a variety of shapes to aid in more efficient storage system designs, and has already been proven to uptake large quantities of other fluids such as nitrogen and oxygen. Recent experimental efforts into the uptake of low-pressure hydrogen gas in aerogel blanket at 77 K, and liquid hydrogen at its normal boiling point will be discussed. Although preliminary in nature, the results of these tests are promising, showing up to a 49% increase in storage density at 77 K over the gas alone, and when brought to normal boiling point conditions, tests show a one-to-one volume equivalency with LH2.

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Session Classification: M3Or2D: Hydrogen Technologies and Compatible Materials