Contribution ID: **207** Type: **Poster**

C2Po2B-01: Design and development of vehicle cryo-compressed hydrogen storage vessel

Tuesday 11 July 2023 14:00 (2 hours)

Safe, compact, lightweight, economical and efficient hydrogen storage technology is the key to the comprehensive development of hydrogen economy. Compared with other hydrogen storage methods, cryo-compressed hydrogen storage has significant advantages in terms of mass hydrogen storage density, volume hydrogen storage density, hydrogen storage cost, safety and evaporation loss. The key component of cryo-compressed hydrogen storage is cryo-compressed hydrogen storage vessel. The current commercialized type III bottle is mainly designed for normal temperature and high pressure, while the key scientific issues of material and container performance under low temperature and high pressure conditions are not clear. It is of great significance to study the low temperature performance of materials and containers, and to explore alternative materials with low cost and excellent mechanical properties for achieving the goal of the United States Department of Energy's hydrogen storage cost and promoting the extensive commercial application of hydrogen fuel cell vehicles.
In order to reasonably design and optimize the performance of cryo-compressed hydrogen storage tank, the author uses carbon fiber and low temperature resin to prepare composite one-way plate from the material, and then makes the one-way plate into relevant splines for testing. The relevant parameters of the spline are tested in the liquid nitrogen temperature zone, such as elastic modulus, Poisson's ratio, thermal conductivity, etc. According to the design requirements of the tank, select the appropriate winding thickness to wind the cylinder. Substitute the relevant parameters into the numerical simulation software to carry out the numerical simulation of the cryo-compressed hydrogen storage tank. Through the performance test platform of cryo-compressed hydrogen storage tank, the relevant parameters of the storage tank under low temperature and high pressure environment are tested and compared with the numerical simulation results. After comparison, relevant parameters are modified and a reasonable numerical simulation correction model is proposed. It provides guidance for the design and use of cryo-compressed hydrogen storage tanks.

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Session Classification: C2Po2B: Hydrogen II: Vessel Design & Testing