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C3Or3B-03: Hydrogen Permeability Testing of Fibre Reinforced Thermoplastics under Cryogenic Conditions –Validation of a Test Rig Concept

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The need to decrease the gross weight of cryogenic hydrogen fuel systems in future zero emission mobility leads to increasing activities in the field of cryogenic lightweight engineering. Fibre reinforced thermoplastic composite materials (FRT) are considered for cryogenic applications despite their bias towards permeation. However, permeation through plastic materials is of major concern in cryogenic applications. Even tiny fluxes can very much compromise the insulating power of high vacuum spaces required for insulation of cryogenic systems such as tank structures or transfer lines. Hence, it is essential to qualify those FRT in terms of their hydrogen permeability for future usage in mobile cryogenic applications. The conventional concepts for measuring permeability in plastic materials are not sufficient for cryogenic measurements of FRT as shown in a previous paper. Therefore, a novel laboratory test rig concept was proposed. In this paper, we validate this concept and show its eligibility for measuring permeation of hydrogen through plastic materials under cryogenic conditions. Furthermore, we show first results of (cryogenic) hydrogen and helium permeation through fluorocarbon polymers like PTFE.

Author: JUST, Thomas (Technische Universität Dresden)

Co-authors: HABERSTROH, Christoph; WILL, Julian (Technische Universität Dresden)

Presenter: JUST, Thomas (Technische Universität Dresden)

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