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Permeability testing of fibre reinforced thermoplastic pipes –validation and results

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A key challenge of designing cryogenic hydrogen fuel systems for future zero emission mobility is the reduction of the overall system weight by using lightweight engineering. Especially in the context of aviation, fibre reinforced thermoplastic composite materials (FRT) are considered as alternative construction materials for fuel line systems. However, permeation of hydrogen through FRT is not negligible, in contrast to conventional stainless steel. Further, their permeability is heavily dependent on the composite's structure as well as the specific geometric shape in which the material is used, in this case as hollow profile structures. Thus, permeability qualification of newly developed FRT must be conducted with specimens that represent the FRT structures in question as well as the influence of the corresponding manufacturing process for tubular structures. Two previous papers already describe the concept and first validation measurements of such a permeability test rig for FRT pipe specimens. This paper completes the validation of this test rig. First results of helium permeation through FRT tube structures at both room temperature and cryogenic conditions are reported. A comparison of room temperature permeation through cryogenically cycled and uncycled samples is also presented as well as the fabrication approach for the tubular FRT samples.

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