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M3Or2D-03: Macro and microscopic properties of 304 steel long-term exposed to liquid hydrogen

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Energy from hydrogen is an appropriate technological choice in the context of sustainable development and for a future CO₂-neutral society. Within the framework of the national hydrogen lead projects, Karlsruhe Institute of Technology (KIT) is working with project partners of the technology platform “TransHyDE” in the lead project “AppLHy!” on the transport and application of liquid hydrogen (LH₂). LH₂ offers important advantages like its high purity, high energy density, storage at low pressure and the provision of a cryogenic temperature level that can be feasible for implementation in transportation applications.

Although austenitic steels have been implemented in LH₂ direct contact for decades now, detailed microstructural and mechanical studies are still missing for 20 K/ that low temperature regime. With an austenitic LH₂ vessel that has been in long-term condition with H₂ exposure in the cryogenic regime as study model, a comprehensive study of the influence of gaseous H₂ and LH₂ on the micro and macro properties of the vessel were carried out. For a complete study and verification of the well-equipped H₂ & LH₂ facilities at KIT, a second short-term hydrogen exposure on the vessel has been carried out.

Within this contribution, the long-term results as well as the short-term exposure will be presented and discussed.

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