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Compatibility of common thermoplastics and elastomers for the hydrogen infrastructure in high pressure hydrogen under cyclic conditions

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Polymers play a key role enabling hydrogen infrastructure activities such as in storage, delivery and dispensing operations at fueling stations. Thermoplastics and elastomers differ in polymer physical and chemical properties significantly. However, under dispensing, storage, delivery and operating conditions of the hydrogen infrastructure, these polymers are expected to perform exceptionally well even under severe environments of high ($\geq +85^{\circ}\text{C}$) and low ($\leq -40^{\circ}\text{C}$) temperatures and cyclic hydrogen pressures from 10-80 MPa. This study compares polymer property changes for thermoplastics (POM, PEEK, Nylon 11, Nylon 6,6, PTFE and HDPE) exposed to high-pressure hydrogen cycled between 17 and 86 MPa at ambient conditions. Custom formulations of NBR and EPDM were exposed under the same exact conditions. Post-exposure characterization of the polymers for changes in physical, chemical, thermal and mechanical properties, showed interesting hydrogen effects that can have a significant influence on performance in hydrogen environments.

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