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IMPACT OF TEST ENVIRONMENTS ON POLYMER TRIBOLOGICAL BEHAVIOURS UNDER RECIPROCATING SLIDING FOR HYDROGEN APPLICATION

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The deployment of hydrogen as a sustainable alternative to fossil fuels demands the use of materials that can ensure safety, durability, and performance across a range of operating conditions. Thermoplastic polymers are increasingly used in hydrogen infrastructure and components due to their chemical stability, low weight, and processability. However, their tribological performance specifically friction and wear behaviour in hydrogen environments remains insufficiently characterized, particularly under reciprocating motion, which is common in seals, valves, and actuators.

This study investigates the effect of different test environments ambient air, dry air, nitrogen, and gaseous hydrogen on the tribological behaviour of three polymer composites: carbon fiber, PTFE and graphite filled PEEK (PEEKCFGrTF), PPS (PPSCFGrTF), and graphite filled polyimide composite (PI3GR). Tests were conducted using a reciprocating pin-on-disc configuration against a mirror-polished 316L stainless steel counterface, simulating conditions relevant to hydrogen system components.

Preliminary findings show that environmental conditions significantly affect both friction coefficients and wear rates, with hydrogen and dry environments generally reducing friction but exhibiting material-specific effects on wear. The results underscore the importance of simulating operational atmospheres when assessing polymer suitability for hydrogen applications.

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