

Early-Stage Uranium-Hydrogen Corrosion Kinetics and Mechanism

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Research into the early-stage uranium-hydrogen degradation mechanism lacks unified interpretation and understanding. This is due to inadequate temporal and spatial-characterization resolution required to unify reaction observations. In this study, white-light interferometry was adapted to characterize the uranium-hydrogen reaction at a temperature of 50 °C and hydrogen pressure of 13.8 KPa. The hydride blister was monitored from induction through critical spallation and UH₃ powder release during rapid surface hydriding. The critical spallation dimensions were measured for height, diameter, area, and perimeter of the first blister. Hydriding growth kinetics were assessed by tracking the first hydride site over the reaction time. Analysis shows that the spall-front velocity of the hydride was changing at a rate of 0.91 μm/min which compares favorably with legacy Sievert's experiments in literature. This work highlights the strength of characterizing the early-stage uranium-hydrogen reaction using white-light interferometry, but more importantly unifying the understanding and mechanism of the uranium-hydrogen reaction kinetics.

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