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Neutron Radiography for Determining the Evaporation/Condensation Coefficients of Cryogenic Propellants[1] K. BELLUR, E.F. MEDICI, M. KULSHRESHTHA, V. KONDURU, D. TYREWALA, C.-K. CHOI, J.S. ALLEN, Michigan Technological University, A. TAMILARASAN, J.C. HERMANSON, University of Washington, J.B. MCQUILLEN, NASA Glenn Research Center, J. LEAO, D.S. HUSSEY, D.L. JACOBSON, J. SCHERSCHLIGT, National Institute of Standards and Technology — A novel, combined experimental and computational approach was used to determine the accommodation coefficients for liquid hydrogen and liquid methane in aluminum and stainless steel containers. The experimental effort utilized the NIST Neutron Imaging Facility to image the evaporation and condensation of cryogenic, hydrogenated propellants inside metallic containers. The computational effort included a numerical solution of a model for phase change in the contact line and thin film regions as well as a CFD effort for determining the appropriate thermal boundary conditions for the numerical solution of the evaporating and condensing liquid. These three methods in combination allow for extracting the accommodation coefficients from the experimental observations. The condensation and evaporation were controlled by adjusting the system temperature and pressure. The computational thermal model was shown to accurately track the transient thermal response of the test cells. The meniscus shape determination suggests the presence of a finite contact angle, albeit very small, between liquid hydrogen and an aluminum oxide surface.

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