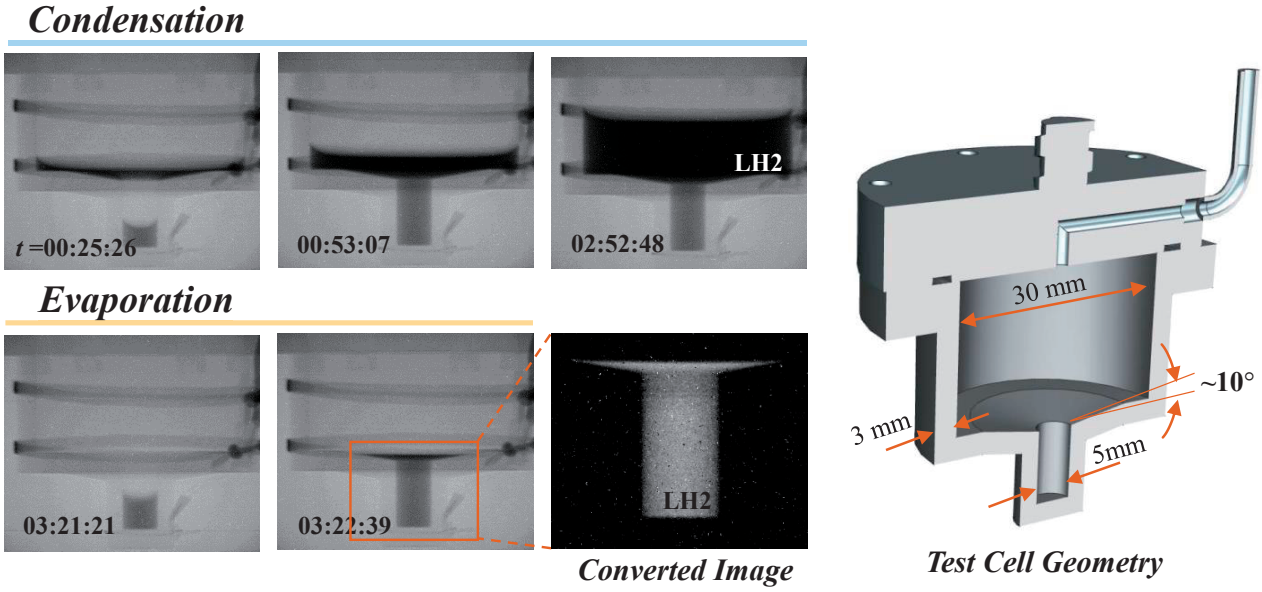

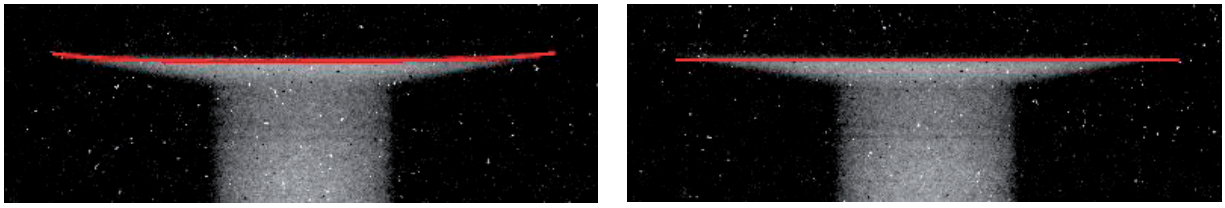

Laplace curve with contact angles of 2° (Left) and 10° (Right)

Examining Liquid Hydrogen Wettability Using Neutron Imaging

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The control of propellant boil-off is essential in long-term space missions. However, a clear understanding of propellant cryogenic condensation/evaporation in microgravity is lacking. One of the key factors in designing such systems is the location of liquid surfaces and the relation to wettability. The BT-2 Neutron Imaging Facility located at the National Institute of Standards and Technology (NIST), Gaithersburg, MD, is used to image evaporation and condensation of hydrogenated propellants inside of an aluminum 6061 container. Liquid hydrogen has larger neutron cross-section area than the aluminum, allowing the visualization of the liquid-vapor interface. The test cell has a conical section that enables determination of a contact angle with enhanced accuracy. If the contact angle is equal to the angle of the cone, a flat liquid-vapor interface is expected. The test cell has the cone angle of 10° and a flat interface was not observed. Using the Laplace-Young equation to fit the interface, the contact angle for hydrogen and aluminum was between 0° and 4°. The theoretical Laplace curves with contact angles of 2° and 10° are plotted on the liquid-vapor interface. The of 2° curve is a closer fit as compared to the 10° curve. The uncertainty arises from resolution limits of the neutron imaging setup and edge detection. More details on the neutron imaging mechanism and relevant physics can be found from the authors' other publication of *Cryogenics,* 74, pp131-137, 2016: doi:10.1016/j.cryogenics.2015.10.016.

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