

MSE 520: SEMINAR SERIES

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Tools For In-Situ and Operando Microscopy—How To Bring Your Bench Top Experiment Inside the Microscope

I will present an overview of sample holders that broaden the stimuli “knobs”—environment, temperature, electric field, etc.—that can be used to observe, with high-spatial resolution, a specimen or device in an electron or x-ray microscope under natural operating conditions. For example, with a standard transmission electron microscopy (TEM) sample holder specimens are observed at low pressures ($\sim 10^{-7}$ mbar) that are incompatible with liquid or gas environments. Now, however, with micro-sized liquid cells we can observe samples submerged on a thin liquid layer routinely in a TEM. I will discuss several examples of this approach where different sample holders have been used to study crystal growth, self-assembly of particles in liquids, oxidation and reduction reactions in gas environments, 2D-based MEMS devices, and the charging of a battery’s primary particles.



Julio Rodríguez Manzo

*Hummingbird Scientific
Lacey, WA*

Julio A. Rodríguez Manzo is an application scientist at Hummingbird Scientific—manufacturer of in-situ electron and x-ray microscopy sample holders in Lacey, WA. Before joining Hummingbird in 2016, he used in-situ microscopy platforms to study the growth of nanomaterials and the function of electronic devices with high spatial resolution at the University of Pennsylvania and the University of Strasbourg, in France—after finishing his PhD on materials science in Mexico (IPICYT). Currently, he is involved in the development and application of new in-situ microscopy instrumentation.



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