

# Exploring Materials Response to Extreme Environments via In-situ TEM

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Some of the most interesting phenomena in nature to study are difficult to replicate due to the extreme environments present. This is especially true when one wants to understand the active mechanisms governing with response with nanometer scale resolution. However, we have recently incorporated a 1064 nm laser into a transmission electron microscope already outfitted with the capabilities to permit quantitative mechanical testing and ion bombardment. These combined capabilities are part of the in-situ ion irradiation TEM (I3TEM) user facility at the center for Integrated Nanotechnologies (CINT). Utilizing this facility, we have been able to explore a range of extreme environments including: the creep dynamics in zirconia at temperatures over 2,000 °C, the irradiation creep dynamics of metallic nanolayers, the water formatting in meteorites, and the formation of rare earth hydrides, oxides, and metals from aqueous solutions.

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