Contribution ID: **145** Type: **Poster**

Hydrogenation of Pd nanoparticles at the nanoscale with in-situ TEM

Sunday, November 27, 2022 11:30 AM (15 minutes)

Palladium is an ideal model system to study hydrogen absorption in metals due to its extreme affinity to hydrogen, high solubility up to H/Pd = 1 atomic ratio, fast hydrogen absorption and desorption at room temperature and simple phase diagram. Pd nanoparticles can be used in catalysis and assist in hydrogen delivery into other materials for hydrogen storage through a spill-over process. Nanoscale systems reveal significant thermodynamic deviations from the bulk due to higher surface to volume ratio, absence of grain boundaries, different behavior of defects and mechanical stress.
In this work, we investigate the behavior of Pd nanoparticles and formation of PdHx in real time with in-situ H2-gas TEM. With the special gas holder from Protochips it is possible to reach pressures up to 1 atmosphere and study the particles at elevated temperatures within the stability limit of the nanoparticles up to 200℃. In this work, we can observe initial stages of hydrogen absorption in Pd nanoparticles, the local phase change at different temperatures and pressures with the help of spectroscopic and diffraction techniques at the nanoscale.

Category

Solid State (Experiment)

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Session Classification: Physics Talks - Micro-/Nanophysics 2

Track Classification: Physics talks