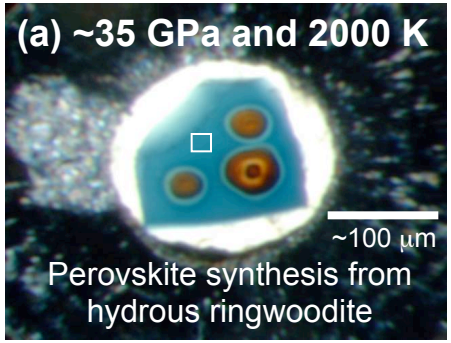
Frontier Synchrotron Infrared Spectroscopy Beamline under Extreme Conditions (FIS)

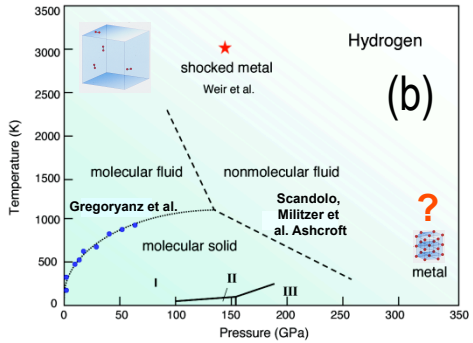
FIS at NSLS-II

- Will enable in-situ optical studies of a wide variety of materials by spectroscopic techniques at extreme P-T conditions (to several hundred GPa and 4~6000 K)
- Measurements of far-infrared to visible spectra with diffraction-limited spatial resolution
- The combination of the high brightness and low noise of NSLS-II with dedicated high-pressure facilities will be unique and world leading

Examples of Science Areas & Impact

- EARTH AND PLANETARY SCIENCES: mimic the mantle extreme conditions and study the Earth's deep water cycle
- MATERIAL SCIENCES: study metallization of hydrogen and hydrogen-rich materials under extreme conditions
- DEEP CARBON CYCLE RESEARCH: study behavior of carbon-bearing materials in Earth's deep interior conditions by vibrational spectroscopy
- DYNAMIC COMPRESSION: probe material behavior on short time scales combined with the pulsed synchrotron radiation





(a) Synthesized perovskite (yellow spots) from hydrous ringwoodite in the sample chamber of a laser heated diamond anvil cell (DAC) (Reid at al., AGU fall meeting, 2006) and (b) hydrogen phase diagram. FIS will enable *in situ* high P-T optical studies of various hydrous minerals as well as hydrogen metallization at extreme high P-T conditions due to the brighter and exceptionally stable infrared source at NSLS-II.

Beamline Capabilities

TECHNIQUE(S): Fourier transform infrared spectroscopy; diamond anvil cell techniques for static high pressure; gas-gun launchers for dynamic compression; cryogenic techniques combined with DACs; laser heating techniques combined with DACs

SOURCE: large-gap (90 mm) dipole magnets

ENERGY RANGE / RESOLUTION: 50 – 10000 cm^{-1} / 1 cm^{-1}

SPATIAL RESOLUTION: diffraction limited resolution in the entire energy range

U.S. DEPARTMENT OF ENERGY

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