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Hydrogen Storage in Mesoporous Materials under High Pressure
MICHELLE WEINBERGER, MADDURY SOMAYAZULU, RUSSELL HEMLEY, Geophysical Lab, Carnegie Institution of Washington — To date, the materials considered best candidates for hydrogen storage fuel cells include activated carbon and metal organic frameworks. Both very high surface area activated carbon and MOF-5 have been shown to adsorb around 4.5 wt % of hydrogen gas at 78 K. We have investigated the fundamental structural response of these materials to high pressure, as well as their behavior at high pressure when packed with dense hydrogen. Further investigation of these materials at low temperatures while still at elevated pressures may in fact provide a route for recovery of these hydrogen-packed materials to near ambient conditions. Covalent organic frameworks offer the potential for even better hydrogen storage capacity. These materials have significantly lower densities than the MOF materials and offer a significantly larger number of adsorption sites. Diamond anvil cells are uniquely suited for the study of these materials, allowing in situ measurements at high pressure as well as at low temperatures. Using X-ray diffraction and Raman spectroscopy and Infrared Spectroscopy we probe the behavior of the hydrogen confined in these porous materials at high pressure by tracking changes in the in situ high pressure x-ray diffraction patterns and shifts in the hydrogen vibron peaks.

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