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Optical studies of compressed silane up to 40 GPa VIKTOR V. STRUZHKIN, XIAOJIA CHEN, OLGA DEGTYAREVA, MUHTAR AHART, YANG SONG, HANNS-PETER LIERMANN, JIAN XU, HO-KWANG MAO, RUSSELL J. HEMLEY, Geophysical Laboratory, Carnegie Institution of Washington, Washington, DC 20015 — Under sufficiently strong compression, hydrogen is believed to be a metal and eventual superconductor with high transition temperatures. Despite an unrelenting experimental assault at ultra-high pressures, dense solid hydrogen has so far defined all attempts at metallization. Recently, Ashcroft suggested that the dense group IVa hydrides would undergo a transition to eventual metallic and superconducting states at pressures considerably lower than may be necessary for hydrogen. We have performed the vibrational study of silane at high pressures up to 31.6 GPa by Raman spectroscopy. By using the fully symmetrical stretching mode as a probe for exploring the phase transition, we find one fluid-solid transition at around 4.0 GPa and two solid-sold transitions near 6.5 GPa and 26.5 GPa at 300 K. After 26.5 GPa, the solid silane becomes opaque. Our x-ray diffraction data also confirmed the high-pressure phase transitions. Moreover, the observed high-pressure structure is irreversible. Although there is no evidence for possible metallization in this pressure regime from our IR measurements, the observation of black hydrogen in solid silane is significant since the pressure used is ten times smaller than that in solid hydrogen.

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