

Abstract Submitted
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Amorphous diamond – A high-pressure superhard carbon allotrope YU LIN, Geological and Environmental Sciences, Stanford University, LI ZHANG, HO-KWANG MAO, Geophysical Laboratory, Carnegie Institution of Washington, PAUL CHOW, YUMING XIAO, High Pressure Collaborative Access Team, Geophysical Laboratory, MARIA BALDINI, High Pressure Synergetic Consortium, Geophysical Laboratory, JINFU SHU, Geophysical Laboratory, Carnegie Institution of Washington, WENDY MAO, Geological and Environmental Sciences, Stanford University — Compressing glassy carbon above 40 GPa, we have observed a new carbon allotrope with a fully sp^3 -bonded amorphous structure and diamond-like strength. Synchrotron x-ray Raman spectroscopy revealed a continuous pressure-induced sp^2 -to- sp^3 bonding change, while x-ray diffraction confirmed the perseverance of non-crystallinity. The transition was reversible upon releasing pressure. Used as an indenter, the glassy carbon ball demonstrated exceptional strength by reaching 130 GPa with a confining pressure of 60 GPa. Such an extremely large stress difference of >70 GPa has never been observed in any material besides diamond, indicating the high hardness of this high-pressure carbon allotrope. The nanoscale transmission x-ray microscopy is being utilized for accurate pressure-volume determination of glassy carbon and its high-pressure phase.

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