Synthesis of a noble metal nitride under extreme conditions.

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Iridium nitride has been synthesized in a laser-heated diamond anvil cell at a pressure above 47 GPa and at temperature of around 2000 K. The compound is stable under ambient conditions.

Transition metal nitrides are of great technological importance traditionally because of their strength and durability, but also because of other interesting physical properties (e.g. optical, electronic, and magnetic [1]). Recently, several experimental and theoretical investigations have been made into the synthesis and properties of nitrides produced under extreme conditions of pressure and temperature. Novel phases of known nitrides have been successfully synthesized [2,3] as well as at least one entirely new compound [4]. The latter work reports the synthesis of the binary noble metal nitride PtN. This material was found to be stable under ambient conditions and to possess a bulk modulus of 372 GPa, remarkable for being nearly 100 GPa higher than the pure metal. Here we report that a recoverable nitride of iridium is produced at pressures of not less than 47 GPa and at a temperature of around 2000 K. The corresponding Raman spectrum (collected from 85 GPa to ambient pressure) exhibits many intense features. We have determined the stoichiometry of the material using x-ray photo-electron spectroscopy and compare the results thus obtained with those of SEM micro-probe investigations. We also report the crystal symmetry of the material on the basis of XRD measurements. We are currently investigating the material hardness using the technique of nano-indentation.

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