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Optical and Raman microspectroscopy of nitrogen and hydrogen mixtures at high pressures JENNIFER CIEZAK, Army Research Laboratory, T. JENKINS, National Institute of Standards and Technology, R. HEMLEY, Carnegie Institution of Washington — Extended phases of molecular solids formed from simple molecules have led to polymeric materials under extreme conditions with advanced optical, mechanical and energetic properties. Although the existence of extended phases has been demonstrated in N2, CO and CO2, recovery of the materials to ambient conditions has posed considerable difficulty. Recent molecular dynamics simulations have predicted that the addition of hydrogen to nitrogen may increase the stability of the cubic-gauche nitrogen polymer and thereby offer the possibility of synthesis at lower pressures and temperatures. Here we present optical and Raman microspectroscopy measurements performed on nitrogen and hydrogen mixtures to 85 GPa. To pressures of 30 GPa, large deviations in the internal molecular stretching modes of the mixtures relative to those of the pure material reveal unusual phase behavior. After an unusual phase separation near 35 GPa, a phase assemblage of consisting of a phase rich in both nitrogen and hydrogen, a phase of relatively amorphous nitrogen and a mixture of the two is observed. Near this pressure, Raman bands attributed to the N-N single bonded stretch were observed.

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