

	Experiment title: Search for the diamondoid form of polymeric nitrogen	Experiment number: HC 3388
Beamline: ID27	Date of experiment: from: February 8 th 2018 to: February 12 th 2018	Date of report: 26/02/2020
Shifts: 9	Local contact(s): Mohamed Mezouar	<i>Received at ESRF:</i>
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The work performed during this beamtime lead to one article.

1. D. Laniel, G. Geneste, G. Weck, M. Mezouar, and P. Loubeyre, Hexagonal Layered Polymeric Nitrogen Phase Synthesized near 250 GPa, *Physical Review Letters* **122**, 2019.

Abstract: The nitrogen triple bond dissociates in the 100 GPa pressure range and a rich variety of single-bonded polymeric nitrogen structures unique to this element have been predicted up to the terapascal pressure range. The nonmolecular cubic-gauche (cg-N) structure was first observed above 110 GPa, coupled to high temperature (>2000 K) to overcome the kinetic barrier. A mixture of cg-N with a layered phase was afterwards reported between 120 and 180 GPa. Here, by laser heating pure nitrogen from 180 GPa, a sole crystalline phase is characterized above 240 GPa while an amorphous transparent phase is obtained at pressures below. X-ray diffraction and Raman vibrational data reveal a tetragonal lattice ($P4_2bc$) that matches the predicted hexagonal layered polymeric nitrogen (HLP-N) structure. Density-functional theory calculations which include the thermal and dispersive interaction contributions are performed to discuss the stability of the HLP-N structure.