

MS15-P07 | TOWARD ONE-POT GREEN SYNTHESIS OF NANOPOROUS CARBON NITRIDES

Dziubek, Kamil (LENS - European Laboratory for Non-Linear Spectroscopy, Sesto Fiorentino, ITA); Fanetti, Samuele (LENS - European Laboratory for Non-Linear Spectroscopy, Sesto Fiorentino, ITA); Nobrega, Marcelo (Universidade de São Paulo, São Paulo, BRA); Citroni, Margherita (LENS - European Laboratory for Nonlinear Spectroscopy, Sesto Fiorentino, ITA); Sella, Andrea (University College London, London, GBR); McMillan, Paul (University College London, London, GBR); Hanfland, Michael (European Synchrotron Radiation Facility, Grenoble, FRA); Bini, Roberto (LENS - European Laboratory for Nonlinear Spectroscopy, Sesto Fiorentino, ITA)

Extended layered nanoporous structures are promising materials that exhibit intercalation properties of conventional 2D layered phases combined with selective diffusion and encapsulation-release behaviour of 3D porous frameworks. Since the seminal work of Kuhn et al. [1], covalent triazine-based frameworks (CTFs) have gained attention as potential catalysts and gas adsorbents. Conventional synthesis methods of this class of materials at high temperature and ambient pressure require, however, presence of Lewis acid catalysts, such as ZnCl₂ [2]. To avoid the use of environmentally harmful reagents new routes of single-step, “green” synthesis of highly crystalline CTFs are intensively sought. We have investigated 2,4,6-tricyano-1,3,5-triazine, a precursor to H-free 2D nanoporous polymers with 1:1 C:N ratio, at high pressure and high temperature conditions using synchrotron X-ray diffraction and FTIR spectroscopy [3]. The new high pressure phase II of the molecular monomer was identified and its structure determined above 2.4 GPa at room temperature. A tentative phase diagram was established, including the I-II phase boundary and the melting line. Polymerization of the phase II was studied between 4 and 10 GPa in the temperature range 300 to 550 K. XRD and FTIR analysis of the reaction products revealed amorphous material and crystalline layered carbon nitride domains. The reaction kinetics indicates that the structural transformation is driven by structural defects.

[1] P. Kuhn et al. *Angew. Chem. Int. Ed.* **2008**, *47*, 3450

[2] M. J. Bojdys et al. *Adv. Mater.* **2010**, *22*, 2202

[3] S. Fanetti et al. *CrystEngComm* **2019**, DOI: 10.1039/C8CE02154F