Journal of Physical Chemistry C 2016 vol.120 N9, pages 5174-5187

High-Pressure Chemistry of Graphene Oxide in the Presence of Ar, N2, and NH3

Ceppatelli M., Scelta D., Tuci G., Giambastiani G., Hanfland M., Bini R.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2016 American Chemical Society.The high pressure structural and reactive beahvior of graphene oxide (GO) in the presence of Ar, N2, and NH3 was studied in diamond anvil cells (DAC) by X-ray diffraction (XRD) and vibrational spectroscopy (FTIR and Raman), with the purpose of investigating the use of pressure for N-doping and functionalization of GO in high-density conditions. The pressure evolution of the interlayer d-spacing of GO during room temperature compression and decompression indicates the pressure-induced insertion of the selected systems between the GO layers and the stability of the GO layered structure at high pressure. Thermal and photoinduced reactivity was studied in GO with N2 and in GO with NH3 in different pressure conditions. The comparison of the infrared spectra of the recovered samples at ambient conditions with respect to the starting GO provides evidence for the occurrence of chemical reactivity of N2 and NH3 with GO, leading to N incorporation and GO functionalization, as also confirmed by the Raman spectra. The observed reactivity opens new perspectives for the high-pressure chemistry of GO and carbon-based nanostructured systems.

http://dx.doi.org/10.1021/acs.jpcc.5b12274