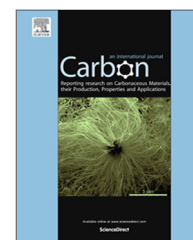


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Lattice expansion of graphite oxide by pressure induced insertion of liquid ammonia



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ARTICLE INFO

Article history:

Received 18 March 2015

Accepted 18 May 2015

Available online 23 May 2015

ABSTRACT

A pressure induced lattice expansion of Graphite Oxide (GO) in presence of NH₃ was observed by X-ray diffraction during room temperature compression and decompression up to 7 GPa in a diamond anvil cell (DAC). A remarkable increase (~11%) of the interlayer d-spacing of GO was observed between 0.2 and 1.1 GPa in the liquid phase of NH₃, indicating the occurrence of molecular insertion between the GO layers. The expansion is reversible with the release of pressure, thus leading to a pressure induced breathing of the GO lattice. The presence of high density NH₃ between the GO layers opens new perspectives for N-doping and chemical functionalization of GO and for designing new advanced carbon based nanostructured materials.

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1. Introduction

Graphite oxide (GO), largely and cheaply available from mass oxidation of graphite, is considered a very promising and versatile platform material for the synthesis of graphene and related 2D carbon based systems [1–5]. GO is a bulk non stoichiometric high-surface layered material, with a nanometric interlayer spacing (0.5–1.5 nm depending on the hydration) sufficiently large for molecular insertion. The characteristic interlayer spacing originates from the oxidation process of graphite and is intimately related to the molecular structure of the single layers of GO, referred to as graphene oxide. In contrast to fully sp² hybridized graphene sheets, the layers

of graphene oxide contain a variable amount of C_{sp³} sites, due to the presence of different oxygen containing functional groups [5,6], decorating the edges and the basal planes of the material. The sp³ hybridization and the introduction of holes, defects and heteroatoms into the carbon layers are responsible for a loss of planarity and for the occurrence of a puckering of the layers. The presence of active sites opens countless possibilities for the chemical functionalization of the graphene oxide sheets towards tailored applications and for the use of GO as a platform material for an entire class of new advanced functional materials [2–4,6–9]. In particular reactivity with N containing moieties, leading to the incorporation of different kind of nitrogen atoms within the graphene

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<http://dx.doi.org/10.1016/j.carbon.2015.05.066>

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