Alkylamine Intercalated Graphene Oxide: Effect of Alkyl Chain Length on Structural Organization and Interlayer Distance

Harshal P. Mungse and Om P. Khatri

CSIR - Indian Institute of Petroleum, Mohkampur, Dehradun - 248005, India

Contact: opkhatri@iip.res.in

Abstract

Graphene, a two-dimensional honeycomb lattice of sp^2 hybrid carbon, exhibit combination of unique characteristics such as high thermal and electrical conductivity, excellent mechanical strength and very high specific surface area, which promises their great potential for various applications including nanoelectronics, catalysis, sensors, energy storage devices, polymer composites and gases adsorptions etc.[1-3] However, large scale production of high quality graphene still remains as a big challenge for these applications. Graphene oxide, an oxidized from of graphene produced by harsh oxidation and then exfoliation of graphite being used largely for preparation of reduced graphene oxide and chemically functionalized graphene for diversified range of applications. Recently, the intercalation of graphene oxide has become area of great interest for its potential applications in adsorption of various gases (CO_2, H_2), high performance supercapacitor electrodes, adsorbents of contaminants and so on.[4-5]

Graphene oxide possesses high degree of oxygen functionalities including hydroxyls, epoxides and carboxylic on their basal planes and edges. In the present work, basal planes oxygen functionalities have been targeted for the intercalation of graphene oxide using *n*-alkylamines. Here, four different types of *n*-alkylamines with variable chain lengths (C_n = 4, 8, 12, and 18) were used for intercalation of graphene oxide. The structural and chemical properties of intercalated products were evaluated by XRD, FTIR, and TG-DTA analyses. Basal planes functionalities were found to interact with alkylamine and increases the interlayer distance between the graphene oxide. During such process some of the basal plane functionalities get reduced and restored the interlayer distance close to the graphitic characteristics. The dispersibility of intercalated graphene oxide in non-polar organic solvents increased with increasing the chain length of *n*-alkylamines. The chain lengths of alkyl amines also plays significant role in order to monitor the interlayer distance. It was observed that with increasing chain length, orientation of intercalated graphene oxide became more ordered and crystalline as revealed by XRD and FTIR analyses. This could be due to increasing van der Waals interaction between intercalated alkyl chains, which usually increases with increasing number of methylene unit in alkyl chains. During the presentation detail model on orientation and interlayer distance of intercalated graphene oxide will be discussed.

References

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