



Research Highlights

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Graphene: Here comes graphane?

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The structure and properties of graphene can be manipulated by reversible hydrogenation

Graphene, a single layer of hexagonally arranged sp^2 -hybridized carbon atoms, has been well studied in recent years because of its interesting electronic properties. The chemical modification of graphene to create derivatives with different structures and properties has so far been restricted to graphene oxide, a disordered structure that bears an assortment of functional groups.

Another possible modification, which has been predicted theoretically, is the addition of hydrogen atoms to graphene — creating 'graphane' — altering the sp^2 carbon atoms to sp^3 and thus changing the structure and electronic properties. Now Andre Geim from the University of Manchester and co-workers from Russia and the Netherlands have hydrogenated mechanically exfoliated graphene by exposing it to hydrogen plasma¹. The electronic properties of the new material change markedly: the highly conductive graphene is converted from a semimetal into an insulator.

Raman studies reveal that the hydrogenation interrupts the π -bonding system of graphene through the formation of sp^3 carbon–hydrogen bonds. Transmission electron microscopy studies indicate that the original hexagonal bonding arrangement is retained, but has a much smaller lattice constant. The hydrogenation is reversible through annealing, thereby restoring the conductivity and structure of graphene. This reversibility also creates the possibility of using such materials for hydrogen storage.

Reference

1. Elias, D.C. *et al.* Control of graphene's properties by reversible hydrogenation. Preprint at <http://arxiv.org/abs/0810.4706> (2008)