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## PRODUCTION OF GRAPHENE IN SOLUTION BY UNZIPPING OF CARBON NANOTUBES

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Chemical modification of the outer graphene layer of carbon nanotubes is an approach increasingly used, mainly to overcome the problem of interfacial bonding with different materials. The effect of functionalization of CNT under different conditions, using the 1,3-dipolar cycloaddition reaction [1], was studied by Scanning Tunneling Microscopy (STM). STM demonstrated the potential for unzipping of the outer graphene layer of CNT modified by the 1,3-dipolar cycloaddition reaction [2]. The unzipping of graphene ribbons from the functionalized CNT was imaged under STM conditions.

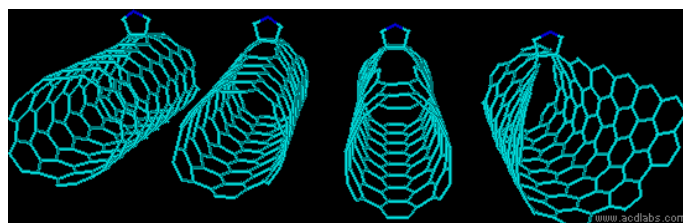


Figure 1: Graphic representation of the unzipping of graphene ribbons from CNT functionalized by the 1,3-dipolar cycloaddition reaction of azomethine ylides.

The present work reports the formation of graphene in solution by unzipping of functionalized CNT. The solutions prepared were studied by UV-Visible and Raman spectroscopy, and electron microscopy. Solutions of exfoliated graphite prepared under similar conditions were studied for comparison.

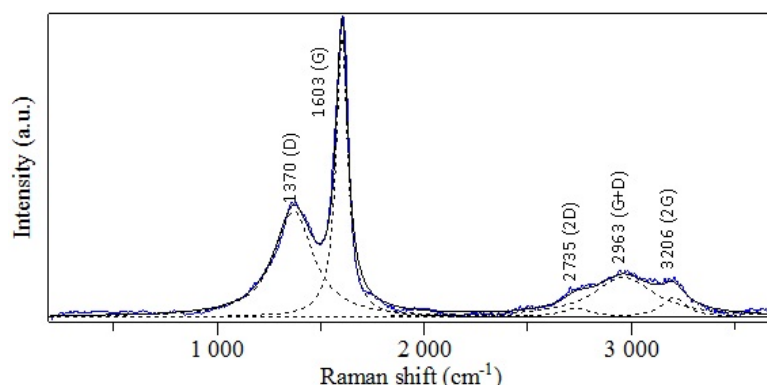


Figure 2: Raman spectra (laser HeCd, 325 nm) of the graphene structure formed by unzipping of CNT in solution. The sample was obtained by solvent evaporation on a glass surface.

**Keywords:** Carbon nanotube; Functionalization; Unzipping; Graphene

[1] M. C. Paiva, F. Simon, R. M. Novais, T. Ferreira, M. F. Proença, W. Xu, F. Besenbacher, *ACS Nano*, accepted for publication.

[2] Paiva, M. C.; Xu, W.; Proença, M. F.; Novais, R. M.; Lægsgaard, E.; Besenbacher, F., *Nano Lett.* 2010, 10, 1764–1768.