Characterization of Graphene made by Chemical Intercalation: HRTEM, SEM, Raman and AFM.

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Currently, the interest of physicists in graphene is enormous, but the interest of chemists has so far not been as great, probably resulting from the absence of well-established large scale methods to produce graphene. Therefore, the most important role chemists can play is the establishment of an inexpensive and simple wet-chemical method for making graphene. For example, intercalation compounds of graphite have been of interest for many years [1]. More than 100 reagents can be intercalated into graphite [2]. Here, we describe an intercalation method to make clean graphene that has good electrical properties (Fig 5) [3]. The graphene material was characterized by TEM (Fig 1), AFM (Fig 2), Raman (Fig 3) and SEM (Fig 4).

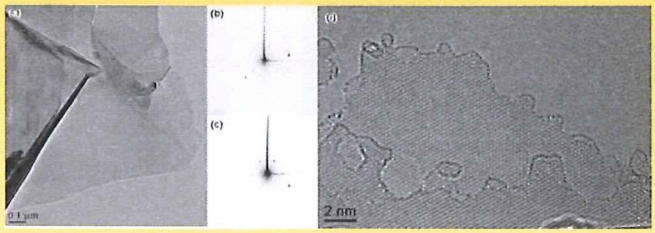

Fig. 1 (a) TEM overview of a graphene flake (b) Electron diffraction of few-layer region, showing the stacking with orientational mismatch of the sheets (c) Diffraction pattern from a single layer region (d) HRTEM detail revealing the presence of clean, single, and bi-layer graphene areas

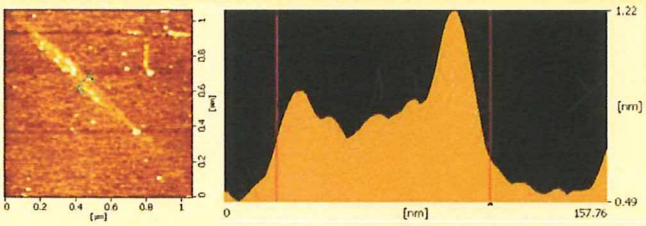

Fig. 2 AFM of monolayer graphene flake

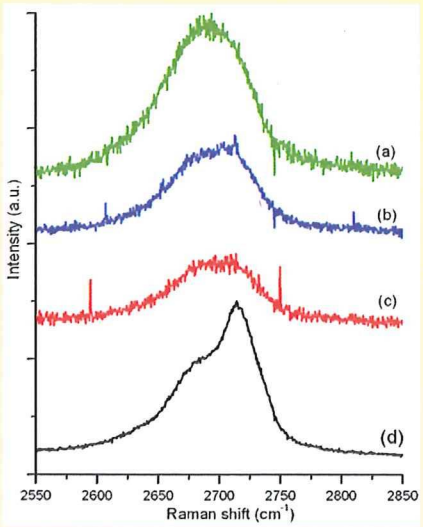

Fig 3 The G' spectra of:-
(a) monolayer graphene flake
(b) bi-layer graphene flake
(c) FLG graphene flake and
(d) HOPG.

Fig. 4 SEM of graphene single sheet, double sheet and multilayer. Contrast is due to the presence or absence of delocalised π-bonding. The thickness of the monolayer graphene is 2.42Å (SEM performed by Dr. Heiner Jaksch, Carl Zeiss NTS GmbH, Oberkochen, Germany)

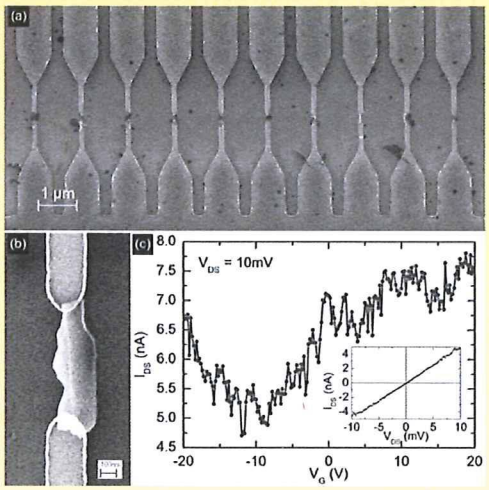

Fig. 5 (a) Scanning electron micrograph of a region of the micro-electrode array showing 10 of the electrode pairs (b) SEM detail of one such device, and the corresponding FET transfer characteristics is shown in (c)

[1] Annu Rev Mater Sci, 1976; 6: 181-211.
[2] Adv Phys, 2002; 51: 1.
[3] Nanoscale, 2010; 2: 2139-2143