Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C
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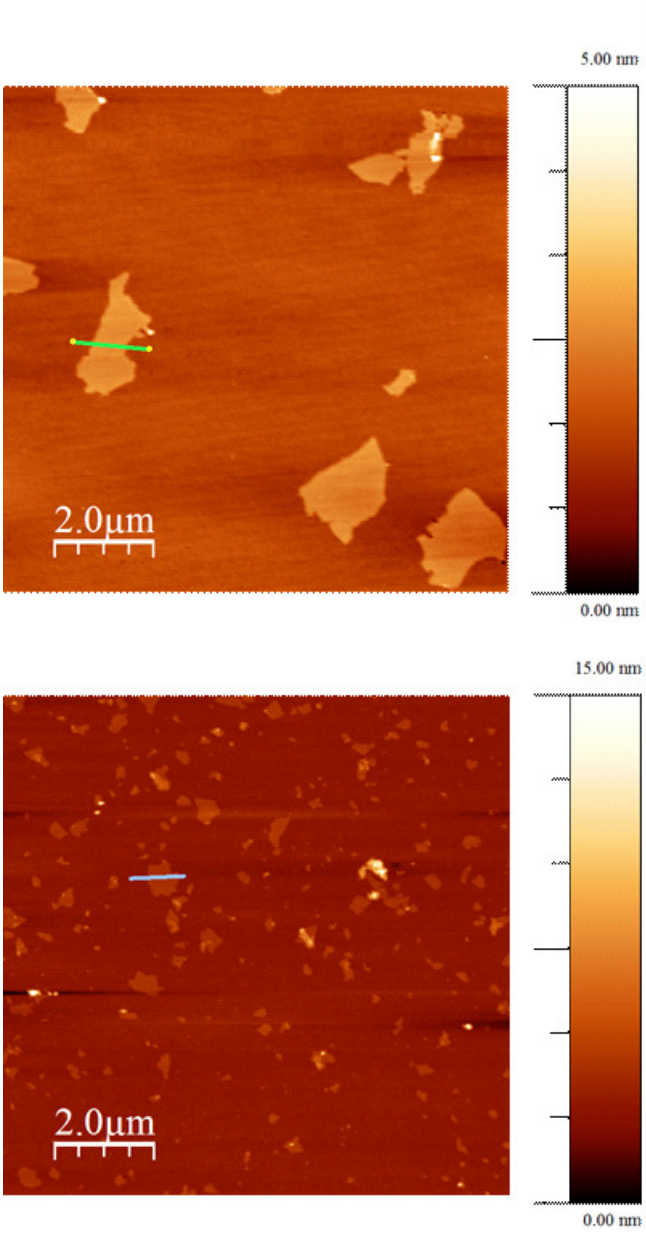
Supporting Information

Figure S1 shows AFM images of individual flakes of GOc (upper image) and GO2 (lower image) graphene oxides.



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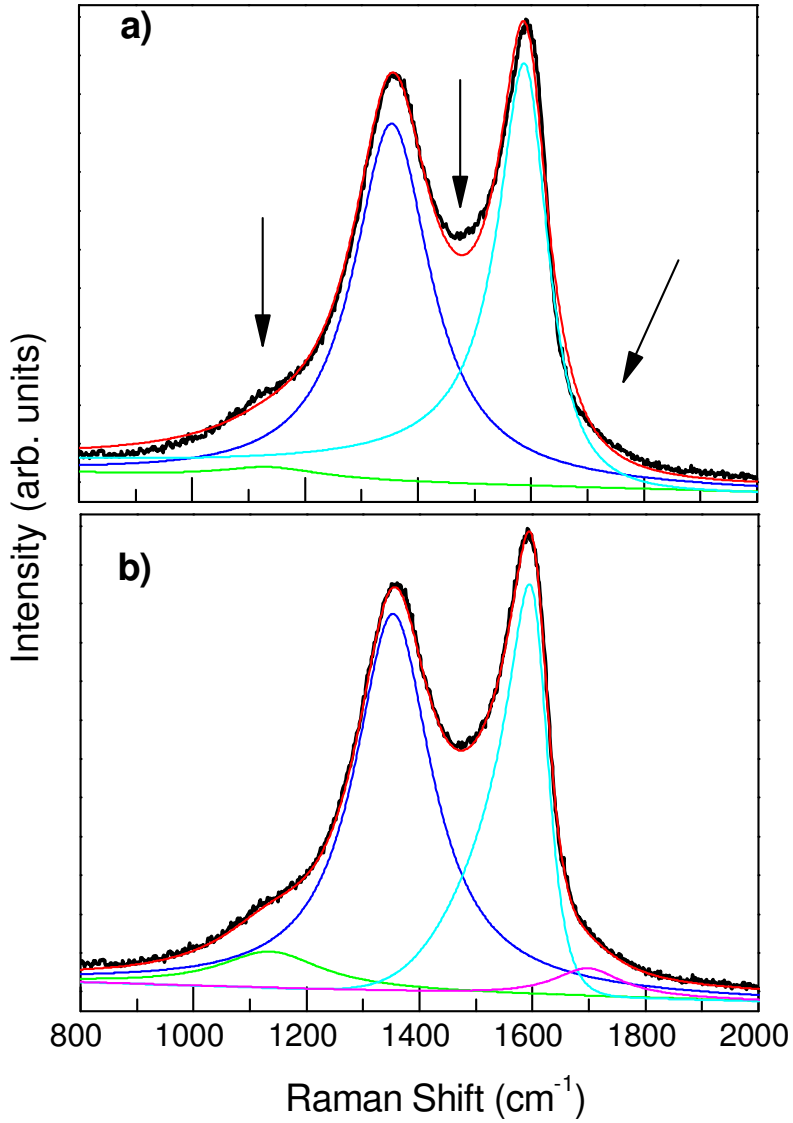
In **Figure S2** we show the comparison between two different fitting approaches for the D-G region of a typical Raman spectrum of a graphene oxide film. We could not fit properly the spectra using a combination of Lorentz functions and Breit-Wigner-Fano (BWF) function (typically used for G peak) (see arrows in (a)). The G peak is well fitted using a Lorentz function with a Gaussian distribution of its width (whose center does not coincide with the peak maximum) and Lorentz functions for the remaining peaks (b).



S2- Two fitting approaches of a typical GO Raman spectrum. The Raman signal of the substrate (glass) was measured in the same conditions and subtracted.

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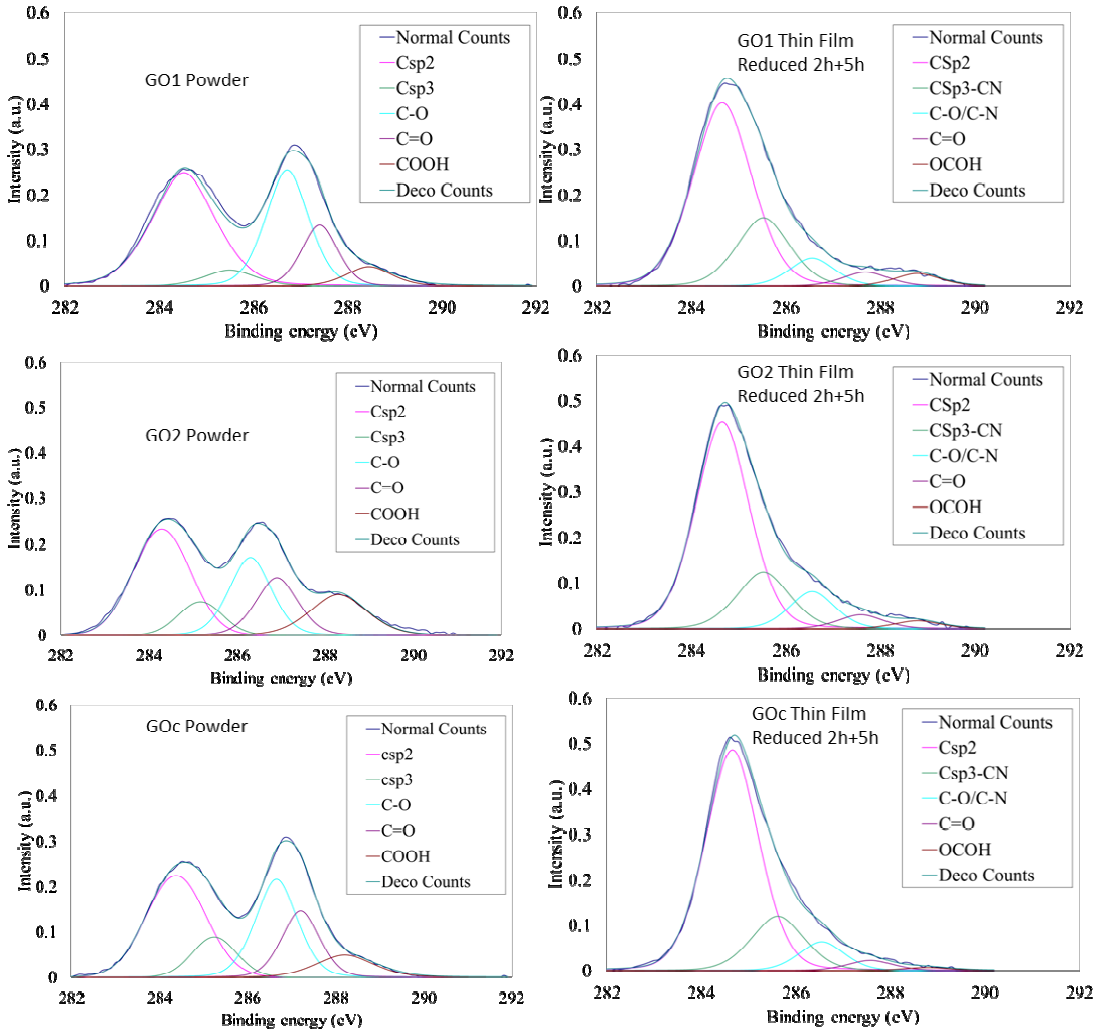
In **Figure S3** we present the XPS data and fitting curves of 6 representative samples: the three GOs in powder (GO1, GO2 and GOc) as well as those of their corresponding thin films reduced in hydrazine for 2h+5h. In all fits the FWHM was maintained below 1.8 eV in all cases and the GL values corresponds to Gaussian (80%)-Lorentzian (20%). The quadratic error was always around 10^{-5}. The software used for deconvolution was CASA XPS.



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In Table **S4**, the N percentages for several thin film samples reduced in hydrazine are collected. Observe that increasing the time in hydrazine increases the N content.

Sample	N(%)
GOc reduced 2h+5h	3.4
GO2 reduced 2h+5h	3.4
GO1 reduced 2h+5h	3.9
GO1 reduced 2h	1.5
GO1 reduced 24h	4.4

In the following **Figure S5** the UV-VIS transmission spectra of two GOc films are shown once the glass contribution has been eliminated. The photograph obtained in transmission corresponds to a film on glass with a sheet resistance of 3.1 kΩ/sq as the mean value within the gold electrodes region. The red circle indicates the position where the spectrum was recorded and the size of the used hole. The right down corner shows a region without graphene.

A precise measure of the transmittance is not straightforward since the samples are not completely homogeneous. The film with a transmission of 93% (blue line) corresponds to a sheet resistance Rs= 14 kΩ/sq. The red spectrum corresponds to a sample with 3.1kΩ/sq. The measured transmittance is 78% at 550 nm but the Raman intensity of the G peak in the region marked with a red circle is 30% higher than that measured in the different channels between the gold contacts. Therefore the film is thicker in this region than between the electrodes. The estimated actual transmittance is in the range between 80 to 90%.