FABRICATION OF TRANSPARENT AND CONDUCTIVE CHEMICALLY CONVERTED GRAPHENE FILMS BY DIP-COATING TECHNIQUE

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Transparent electrodes are crucial components in modern electronics. They are generally produced from indium thin oxide (ITO) and due to globally diminishing stocks of indium, are becoming more expensive. In addition, for many future applications, electrodes will need to be flexible, a development that can not be accomplished by ITO. The recent discovery of graphene by Geim and Novoselov [1] has generated a great interest worldwide due to its unique mechanical, optical, thermal and physical properties. Graphene based transparent conductive films (TCFs) are cheaper, far more flexible than traditional ITO films, and have promising applications in future bendable electronic and optoelectronic devices. Currently, mechanical cleavage of graphite is able to make high quality graphene reaching a millimeter size but with a very low yield. Alternatively, chemical exfoliation starting from the oxidation of graphite is an efficient process to produce graphene on a large scale and at low cost, combined with post-reduction processes.
Here we report, a new, simple and low cost approach for preparing large area transparent and conductive films using Chemically Converted Graphene (CCG) dispersions and polycations. First a CCG suspension was synthesized by reducing graphene oxide in presence of Hydrazine [2] solution. Then, graphene films were deposited onto glass and silicon substrates at ambient temperature by a dip-coating technique based on the layer by layer LBL method. An automated high-throughput set-up (Fig. 1) was developed for the purpose, by using a commercial robotic arm to dip 24 substrates in parallel. The set-up includes in-house made instrumentation for on-line measurement of conductivity and transmittance. The properties of the obtained films have been investigated by Raman spectroscopy, scanning electron microscopy (SEM) and atomic force microscopy (AFM). The resulting CCG films (Fig.2) show promising electrical and optical properties.

Figure 1: The experimental set-up: (a) sample holder, (b) overview of the set-up

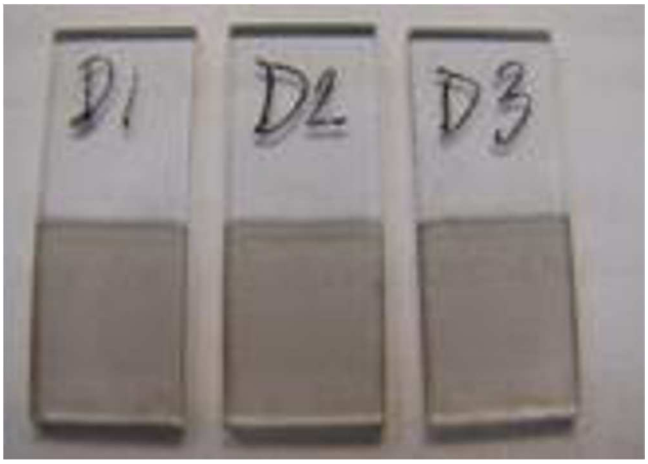

Figure 2: Thin films of Chemically Converted Graphene on glass substrates

References

[1] K.S. Novoselov *et al.*, Science 306 (2004) 666-669.
[2] S. Stankovich *et al.*, Nature 442 (2006) 282-286.