Automated Graphene Transfer System for Graphene solar cells

Javier Martinez[1, 2], A. Boscá[1, 3], J. Pedrós[1, 3], A. Ladrón de Guevara[1, 3], S. Fernandez[4], J. Carabe[4], A. Molinero[5], J. M. Barcala[5], M. B. Gómez-Mancebo[6], I. Rucandio[6], R. Fernandez-Martinez[6], A. J. Quejido[6], L. J. Bonales[6], J. Cobos[6], F. Calle[1, 3]

[1]Instituto de Sistemas Optoelectrónicos y Microtecnología, UPM, Madrid, 28040, Spain
[2]Dpto. de Ciencia de Materiales, E.T.S.I de Caminos, Canales y Puertos, UPM, Madrid, 28040, Spain
[3]Dpto. de Ingeniería Electrónica, E.T.S.I de Telecomunicación, UPM, Madrid, 28040, Spain
[4]Unidad de Energía Solar Fotovoltaica, CIEMAT, Avda. Complutense 40, Madrid, 28040, Spain
[5]Unidad de Electrónica, CIEMAT, Avda. Complutense 40, Madrid, 28040, Spain
[6]Division de Quimica, CIEMAT, Avda. Complutense 40, Madrid, 28040, Spain
javier.martinez@upm.es

Although graphene grown by chemical vapor deposition (CVD) has proven to be an excellent material for electronic applications [1], an inconvenience of this method is the need of transferring the thin graphene layer from the initial metal catalyst to a suitable final substrate. A manual transfer method was developed in order to overcome this issue. It consists of protecting the graphene with a polymer layer, wet-etching the growth substrate, cleaning with deionized water and finally depositing the resulting polymer/graphene membrane onto the desired target substrate. Some drawbacks of this method are that it requires handling skills to perform it, that it is time consuming, and that it is not suitable for an industrial process. An optimized method based on a roll-to-roll system can overcome some of the manual method limitations, but it is mainly focused on flexible, transparent electrodes applications.

We report a lab-scale system designed to automatically transfer graphene to arbitrary substrates [2], but adapted it for industrial applications like solar cells. The system is composed of several modules that control the process temperature, the liquid flow and the overall system state. A microcontroller is used as the real-time control. The passive components of the system are depicted in Fig. 1. A PTFE tube encloses the graphene sample during the whole process. All this pieces are immersed in a liquid, starting with an etchant solution and changing gradually into deionized water for the final steps. Finally, graphene solar cells were processed using a manual method and our automatic method for comparison, showing higher mobilities and less charge impurities for the latter one.

References

[1]   J. Pedros et al., Journal of Power Sources (2016) **317**, 35
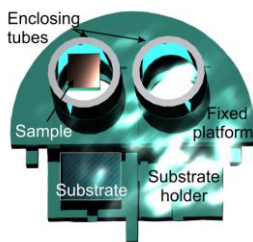[2]   A. Bosca et al., Scientific Reports (2016) **6**, 21676

Figures

Figure 1: Graphene automated transfer system

NanoSpain
Conf 2017