Polymer/ graphene "pastry*" for flexible touch screens

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Abstract

Thin films supported on substrates are of technological importance and are commonplace in biological systems such as cell walls and hard skins on soft plant and animal tissues.

Stacks of graphene that are laid onto a flat transparent polymer substrate constitute the main part of a flexible touch screen where transparent and conductive electrodes are needed [1]. The number of stacked graphene layers defines the optical transmittance of the screen as well as the conductivity for either resistive or capacitive mode of operation [2]. Both transmittance and conductivity are functions of the quality of the grown graphene layer and, more importantly, of its morphology after the attachment onto the target substrate[3]. Conventional wet transferring techniques involve intermediate carrier films, and therefore several contact and separation events before the deposition of the graphene layer on the target substrate. Such processes result in a transfer-induced texturing of graphene with folds, wrinkles and cracks.

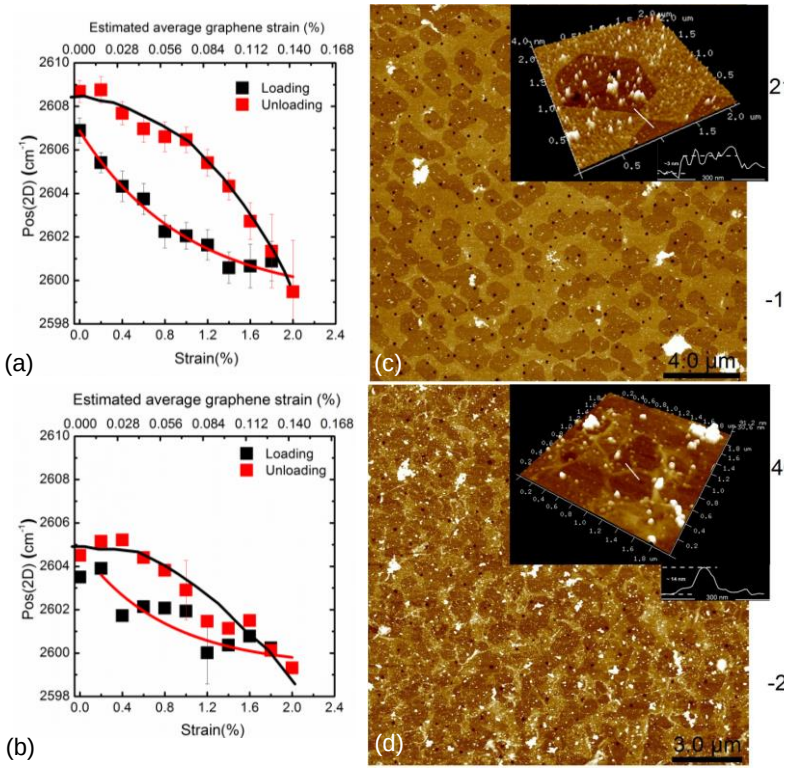

Figure 1: *Pos(2D) as a function of tensile strain and AFM images for PET/1LG (a,c) and PET/3LG stacks. In (a) and (b) the curves are guide to the eye. In (c) and (d) the highest(white) features are residues from the transferring procedure.*

In the present work a systematic investigation is carried out for morphological, mechanical and electrical characterization of graphene stacks on PET substrates ('pastries'). In particular, samples consisted of one (1LG), two 2LG) and three (3LG) graphene layers deposited onto a transparent PET film of 125 μm in thickness by the 'bubbling' technique were supplied by BGT Materials. By means of SEM and AFM microscopies, the texturing of the PET surface after stacking sequentially a number of graphene layers was identified. The texturing of the 1LG resembles to a thin film under biaxial compression that has been buckled into wrinkles and folds (Fig.1c-inset)[5]. The subsequent stacking from 2LG up to 3LG results in a different pattern on the PET surface (fig. 1d). Within this pattern the folds are broader (~150 nm) and higher (~15 nm) delineating individual domains (fig. 1d-inset). The structure of these folds is explored by Tip Enhanced Raman microscopy (TERS). Finally, uniaxial tensile tests in combination with Raman measurements (fig. 1a, b) were performed to assess the interlayer and the PET/ layer adhesive interactions in each stacking configuration. Finally, PET surface modification strategies could be used to control the texturing of the graphene stacks and thus inducing additional functionalities in the material[2].

References

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* https://en.wikipedia.org/wiki/Pastry