The performance of few-layer graphene/natural polymer films produced by layer-by-layer

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Abstract

Natural polymers such as chitosan (CHI) and alginate (ALG) are biocompatible materials suitable for implantable devices, however present weak mechanical properties. Mechanical reinforcement can be enhanced with processing techniques that buildup nanostructure such as layer-by-layer assembly (LbL). In the present work suspensions of functionalized graphene nanoflakes (f-GF) and nanoribbons (f-GNR) were prepared from expanded graphite (EG) and multi-walled carbon nanotubes (MWNTs), respectively. The f-GF and f-GNR were produced by different methods [1,2,3]. The layer-by-layer deposition of f-GF or f-GNR and CHI/ALG was investigated and free standing films were produced. The weight incorporation of f-GF and f-GNR was measured. The films were characterized in terms of morphology, mechanical and electrical properties, swelling in water and cytocompatibility. It was observed that graphene increased the storage modulus and dynamic mechanical response at 1Hz and 37ºC, and decreased the electrical resistivity. Biological assays revealed cytocompatibility towards L929 cells. In conclusion, these new f-GF and f-GNR reinforced free standing films present potential for biomedical applications.

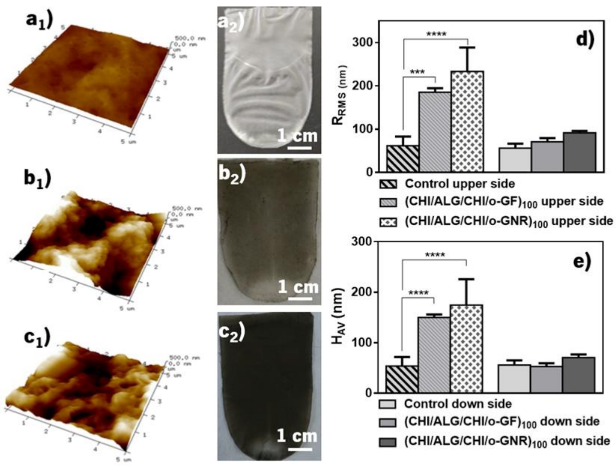

Figure 1. 4 AFM 3D surface images of: a_1-controls FS films, a_2-(CHI/ALG/CHI/o-GF)100 films and c_1- (CHI/ALG/CHI/o-GNR)100 films. (d) RRMS and (e) is the HAV. Photographs of the different films are shown in a_2, b_2 and c_2.

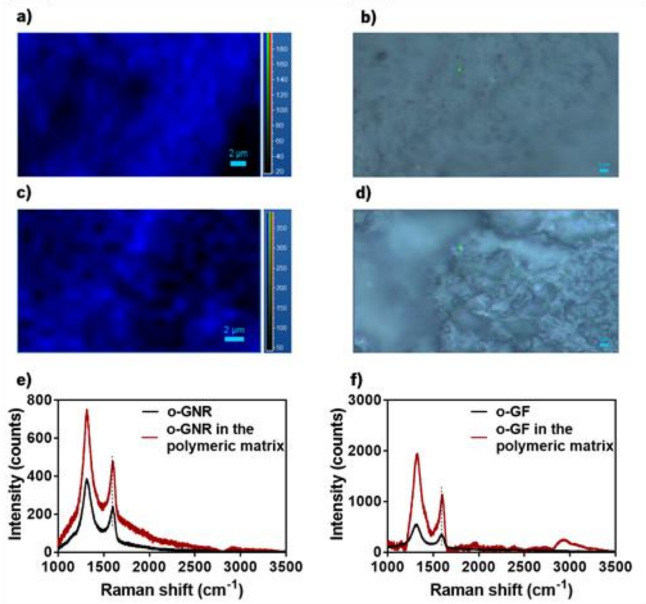

Figure 2. Distribution of o-GNR and o-GF in the CHI/ALG matrix obtained by Raman spectroscopy (a,c); optical image of the o-GNR and o-GF composite films(b,d); Raman spectra obtained for the o-GNR and o-GF before (black line) and after CHI/ALG film production (red line, respectively (e,f).

References

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