Effect of Graphene Nano-platelet Morphology on the Elastic Modulus of Soft and Hard Biopolymers: A Comparative Study

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Abstract: Two bio-polyesters having diverse elastic (Young's) moduli (soft and hard) were reinforced (0.1-5 wt.%) with various types of expanded graphite nanoplatelets (GnP flakes) [1]. Free standing biocomposites were fabricated by solvent casting and hot-pressing. Detailed mechanical measurements were conducted in order to investigate the effect of GnP thickness and lateral size on the elastic modulus of both polymers. For comparison purposes other 2D and 3D nanoscale fillers were also used such as organoclay, MoS_2, carbon black, Iron dioxide and silica nanoparticles (see Figure). Under solvent casting conditions, GnPs did not perform better compared to other model fillers in increasing the elastic modulus of the soft bio-polyester. On the other hand, GnPs increased the elastic moduli of the hard bio-polyester biocomposites more than other fillers. Due to hot-pressing induced alignment of the 2D flakes with the polymer matrices, large (~ 1μm) many layer GnPs (≥8) induced better elastic moduli enhancement performance compared to other GnPs and 2D and 3D fillers at 3 wt.% concertation levels. Large many layer GnPs also suppressed elastic modulus decline of the soft bio-polyester due to heating near its melting point.

References

[1] Jang et al., Journal of Material Science, **43** (2008) 5092.

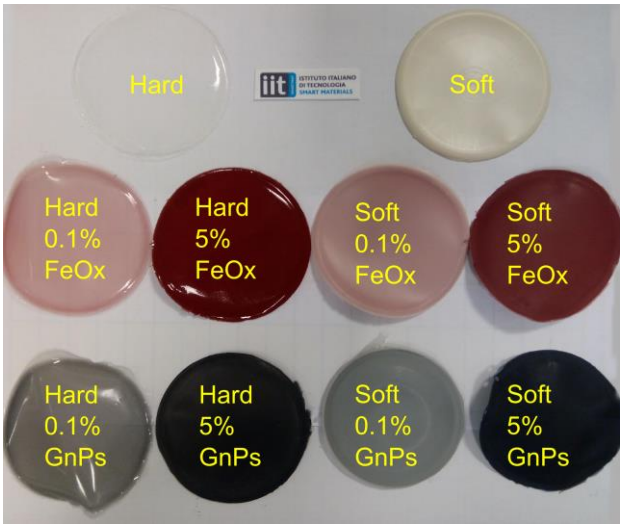

Figure: Photo of different films obtained with Hard and Soft biopolymer matrixes. At the top of the figure the two pure matrix are showed. Underneath some nanocomposites obtained with iron oxide (FeOx) and GnPs are displayed.