TiO_2-EPE/CTA nanocomposites: solvent casting vs solvent vapour annealing

Joseba Gomez-Hermoso-de-Mendoza, Junkal Gutierrez, Agnieszka Tercjak

`Materials+Technologies´ Group (GMT), Department of Chemical and Environmental Engineering, Faculty of Engineering Gipuzkoa, University of the Basque Country (UPV/EHU), Plaza Europa 1, 20018 Donostia-San Sebastián, Spain.
joseba.gomezh@ehu.eus

Materials based on biodegradable polymers and modified with inorganic nanoparticles are indispensable to reduce the problems generated by plastic waste [1]. However, they are not as competitive as the conventional materials, and therefore employment of different preparation methods are necessary to improve their properties [2].

In this work [3], cellulose triacetate based nanocomposites modified with sol-gel synthesised TiO_2 nanoparticles and EPE triblock copolymer have been prepared by two different methods. In the case of solvent casting (SC) pathway, solutions were cast in petri dishes and kept at ambient conditions until solvent evaporation. On the other hand, in the solvent vapour annealing (SVA) method, nanocomposites were dried in an oven under an acetone vapour atmosphere.

Nanocomposites prepared by SVA presented smoother surfaces than SC nanocomposites, and in consequence, higher gloss values. Moreover, as observed in Figure 1a, they displayed a great surface finish without visible defects and high transparency at 650 nm even at high sol-gel content. As for AFM phase images, they showed that the preparation methods affected the self-assembly ability of the EPE triblock copolymer, and therefore, the morphology of the nanocomposites. In the case of 10TiO_2-EPE/CTA, SC sample presented a heterogeneous system, whereas SVA films a homogeneous one (Figure 1b). This is reflected in the mechanical properties, since SVA nanocomposites presented higher Young's modulus and tensile strength than SC ones. Finally, UV-shielding properties were not affected by the preparation method.

References

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Figures

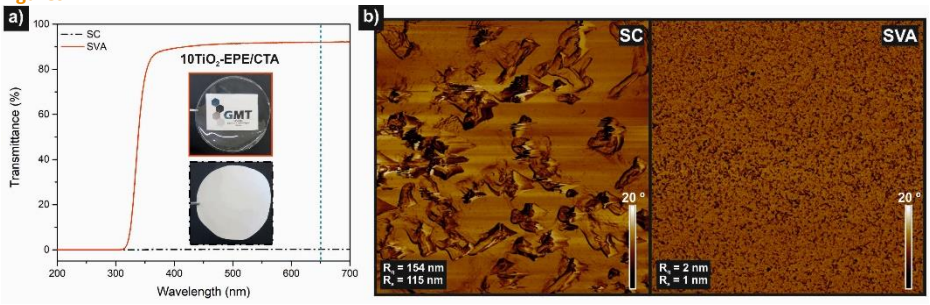

Figure 1: a) UV-vis spectra and digital images and b) phase images (5 µm X 5 µm) of 10TiO_2-EPE/CTA prepared by SC and SVA.