Development of Polyurethane/r-GO Nanocomposites with Reinforced Self-healing Properties

E. Giannakaki[1,2,*], K. Giannaris[1,3], M. M. Stylianakis[1,4], A. Fidelli[5], P. Krassa[5], K. Chrissopoulou[1] and S. H. Anastasiadis[1,2]

[1]*Institute of Electronic Structure and Laser, Foundation for Research and Technology-Hellas, Heraklion Crete, Greece.*
[2]*Dept. of Chemistry, Univ. of Crete, Heraklion Crete, Greece.*
[3]*Dept. of Materials Science and Technology, Univ. of Crete, Heraklion Crete, Greece.*
[4]*Dept. of Nursing, Hellenic Mediterranean University, Heraklion Crete, Greece.*
[5]*Megara Resins, Anastassios Fanis, S.A. Megara, Greece.*

In recent years, self-healing coatings have been the subject of increasing research interest due to their ability to self-repair local damages caused by external forces. Polymeric materials comprise one of the most promising materials to use towards this direction [1]. Waterborne polyurethane dispersions (WPUD) have attracted broad attention due to their advantage of low release of volatile organic compounds (VOCs). WPUD have a wide range of commercial applications in coatings, adhesives, and other consumer products. On the other hand, graphene derivatives are widely used to reinforce the mechanical and thermal properties of WPUDs. In the current work, reduced graphene oxide (r-GO) was incorporated within a waterborne polyurethane dispersion based on polycarbonate polyol to develop nanocomposites in different compositions and investigate its effect on the self-healing properties. Initially, the graphene oxide (GO) was synthesized via a modified Hummers method and was subsequently reduced using hydroiodic acid (HI) as a reducing agent to prepare the r-GO. The self-healing ability of the polyurethanes was found enhanced in the nanocomposites and the healing rate was found much higher compared to that of the pure polymer, as confirmed by microscopic and thermal analysis techniques, mainly due to better heat dissipation. The superior heat conductivity of r-GO allowed for the optimization of the self-healing ability with the incorporation of just a small amount of the additive (Figure 1), whereas its presence enhanced the mechanical properties of the nanocomposites after healing, as well.

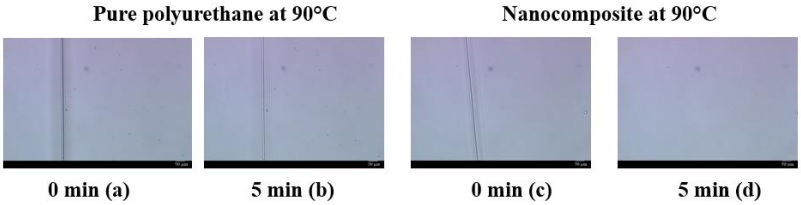

Figure 1: Optical Microscopy images of the self-healing of a crack in a pure polyurethane film (a and b) and a polyurethane/r-GO film (c and d).

References

[1] S. Utrera-barrios, R. Verdejo, M.A Lopez-Manchado and M. Santana, Materials Horizons, **7**, 2882–2902 (2020).

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* evigian@iesl.forth.gr