

Influence of polymer structure over optical properties in different azo modified epoxy systems

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Abstract – An azo prepolymer (TAZ) was synthesized by reaction between Disperse Orange 3 (DO3) and diglycidyl ether of bisphenol A (DGEBA). The resulting TAZ was blended with DGEBA and different amines (mono and diamines) in order to obtain linear and crosslinked polymers. The influence of crosslinking over optical properties has been analyzed and the results compared to the behavior observed in thermoplastic epoxies.

Functionalized polymers with azobenzene chromophores covalently attached to the polymer main chain are versatile materials for constructing a variety of optical devices. [1] Researchers have investigated covalent attachment of the chromophore to the polymer as either pendant group or a comonomer, or crosslinking the active moiety into the polymer system. In our case, we have previously studied the reaction kinetics and the optical storage characteristics of two azobenzene functionalized epoxy-based thermoplastic copolymers and a homopolymer containing Disperse Orange 3, and have contrasted the results with two guest-host systems. [2-4] In an effort to establish materials with the desired optical storage properties, it has been also investigated a series of crosslinked epoxy-based azopolymers, each with distinct differences in the molecular structure of the unit building blocks. [5] We discussed to what extent the polymer structure can influence chromophores phoroorientation, and we showed that some polymeric epoxy systems provide good results in terms of optical storage and stability. As in previous works, an azo prepolymer (TAZ) was synthesized by reaction between Disperse Orange 3, and diglycidyl ether of bisphenol A (DGEBA). [2] Selected amounts of TAZ were blended with DGEBA and polymerized with two different monoamines, one aliphatic and one aromatic, benzylamine (BA) and m-toluidine (MT) and diamines, either meta-xilylenediamine (MXDA, Aldrich) or polyetheramines (Jeffamine D series, D230 and D400, Hunstman). In this work, the influence of crosslinking over maximum birefringence attained and remanent birefringence is analyzed in the networks and compared to the values obtained for the thermoplastic materials. As is shown in Figure 1 the maximum birefringence values are higher for crosslinked polymers in comparison with thermoplastics with similar azo chromophore content. In addition, for similar T_g values, in crosslinked polymers the remanent birefringence exhibit significant higher values with respect to thermoplastics.

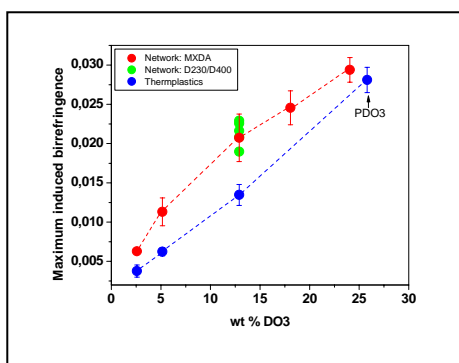


Figure 1: Maximum birefringence vs. DO3 content.

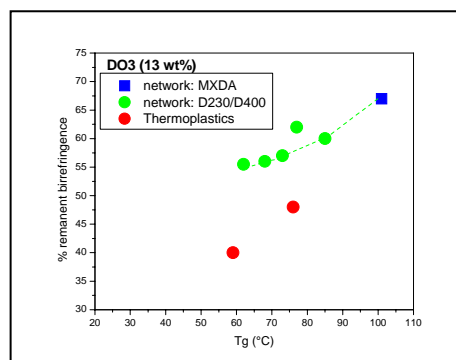


Figure 2: Remanent birefringence vs. Tg.

References

- [1] A. Natansohn and P. Rochon. P. Chem. Rev, 102 (2002) 4139.
- [2] R. Fernández, I. Mondragon, P. A. Oyanguren, M. J. Galante. React. Funct. Polym, 68 (2008) 70.
- [3] R. Fernández, I. Mondragon, M. J. Galante, P. A. Oyanguren. Eur Polym. J, 45 (2009) 788.
- [4] R. Fernández, M. Blanco, M. J. Galante, P. A. Oyanguren. I. Mondragon, J. App. Polym. Sci. in press.
- [5] R. Fernández, I. Mondragon, M. J. Galante, P. Oyanguren. J. Polym. Sci., B: Polym. Phys. in press.