NANOSTRUCTURED BLENDS OF STYRENIC BLOCK COPOLYMER AND EPOXY RESIN: MORPHOLOGY-DEFORMATION MECHANISM CORRELATION

[a] Rameshwar Adhikari, [a] Rajesh Pandit, [b] Albrecht Berkessel [c] Ralf Lach, [c] Wolfgang Grellmann, [d] Werner Lebek, [d] Goerg H. Michler,

[a] Central Department of Chemistry, Tribhuvan University, Kathmandu, Nepal
[b] Department of Chemistry, University of Cologne, Greinstraße 4, Cologne, Germany
[c] Centre of Engineering, Martin-Luther University Halle-Wittenberg, Halle/Saale, Germany
[d] Department of Physics, Martin-Luther University Halle-Wittenberg, Halle/Saale, Germany
E mail: nepalpolymer@yahoo.com

ABSTRACT

Epoxy resins are important thermosets having several technical application potential. However, their effective application range is limited by their inherent brittleness. Many works have been carried out to improve their physical properties, mainly through the incorporation of flexible elastomeric domains within the brittle epoxy network. One of such ways includes the toughness modification of the resins through the addition of the block copolymers. The latter induces nanostructured morphology in the resin. In this work, we investigate the binary blends of a star shaped polystyrene-*block*-polybutadiene-*block*-polystyrene (SBS) triblock copolymer with epoxy resin, (diglycidyl ether of bisphenol-A; DGEBA), in presence of methylene dianiline (MDA) as hardener. The SBS samples were epoxidized by using *meta*-chloroperoxybenzoic acid (MCPBA). It was found that the interplay between macro- and microphase separation in those blends occurs depending upon the degree of epoxidation of the block copolymer. The techniques used were Fourier transform infrared (FTIR) spectroscopy and electron microscopy (TEM as well as SEM) for the morphological characterization and microindentation tests for the determination of mechanical properties. The presence of nanostructured morphology was attested by the optical transparency of the blends as well as of the composites with nanofiller. Consequently, the mechanical properties of the blends could be adjusted by controlling the degree of epoxidation and amount of the block copolymer used to prepare the blends. A brittle to ductile transition was observed in the copolymer modified epoxy resin. The correlation between morphology and micromechanical deformation behavior

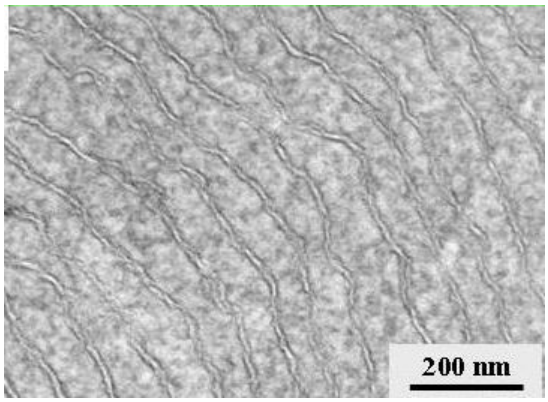

Fig. 1: TEM image of a blend comprising 70 wt.-% of epoxy resin and 30 wt.-% of epoxidized (eSBS) block copolymer