A nanostructured, highly flexible and optically transparent epoxy nanocomposite was developed reacting diglycidyl ether of bisphenol-A (DGEBA) with amine functionalized polydimethyl siloxane (PDMS). The concentration of PDMS varied up to 7 wt%. The nanocomposites exhibited nanodroplet morphology with up to 180 nm diameter PDMS droplets well dispersed in the epoxy. Strikingly, PDMS induced a threefold increase of strain at fracture and toughness. Furthermore, hydrophobic behavior was induced by PDMS, the water contact angle increased 72° (neat epoxy) up to 110° at 5 wt% PDMS content. The nanoconfined droplets induced a two-glass transition behavior, an upper \( T_g \) associated to the epoxy matrix, and lower \( T_g \) associated with an interpenetrated shell around the PDMS nanodroplets. The mechanical and two-\( T_g \) behavior was further studied by applying thermal annealing for periods of time. The resulting mechanical and thermal properties are correlated with the morphology as characterized in detail by atomic force microscopy (AFM), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). These nanocomposites are attractive for coatings/encapsulates with improved flexibility, toughness, optical transparency and water resistance.

**Keywords:** Nanocomposites, Toughness, Epoxy resin

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