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Critical rubber layer thickness of core-shell particles with a rigid core and a soft shell for toughening of epoxy resins without loss of elastic modulus and strength

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Abstract: Core-shell particles with a rigid silica core and a poly(butyl acrylate) (PBA) rubber shell are used to toughen epoxy resins without loss of elastic modulus and tensile strength. Both the diameter of silica core (D) and thickness of PBA shell (T_s) of silica-PBA core-shell particles are accurately controlled by sol-gel synthesis and seed emulsion polymerization process, respectively. From the results of notched Izod impact tests, a brittle-ductile transition of these epoxy/silica-PBA composites occurs when the rubber shell thickness (T_s) exceeds a critical value (T_{sbd}). It is found that T_{sbd} increases with increasing D which implies a critical rubber content (10 wt.%) in the core-shell particles or

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