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Facile synthesis of imidazole microcapsules via thiol-click chemistry and their application as thermally latent curing agent for epoxy resins

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Abstract A novel method was developed to encapsulate 1-benzyl-2-methylimidazole (1B2MZ) to produce microcapsule-type latent curing agent using thiol-click reaction in an oil/water emulsion. The fabrication process was significantly simplified and required reaction time was greatly shortened due to the efficiency of click chemistry. In the oil phase, 1B2MZ was mixed with reactive monomers, 1,3,5-tri-2-propenyl-1,3,5-triazine-2,4,6 (1H, 3H, 5H)-trione (TTT) and tris[2-(3-mercaptopropionyloxy)ethyl] isocyanurate (TEMPIC) which would polymerize to result in polythioether shell of microcapsules by following a photoinitiated thiol-ene mechanism. Polyvinyl alcohol (PVA) aqueous solution acted as water phase. The whole reaction process lasted for 20 min, which was enough for almost full conversions of monomers. The generated latent curing agent had good spherical shapes with smooth outer surfaces and the mean diameter distributed in the range of 105.7 to 18.17 μm by adjusting PVA concentration or viscosity of oil phase. The curing behavior, kinetics and releasing mechanism of latent curing agent were studied by differential scanning calorimetry (DSC) and scanning electron microscope (SEM). This microcapsule-type latent curing agent had a long storage life for 30 days when mixed with epoxy resin at 20 °C, and the mixture could be cured at 100 °C within 1h.

Keywords: Functional composites; Polymers; Smart materials; Differential scanning calorimetry

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