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Abstract

Vitrimers, thermosets with exchangeable covalent bonds, have recently attracted increasing attention in the field of functional polymer materials. However, their transesterification rates and electrical properties are inadequate for many practical applications. In this study, we showed that doping vitrimers with conductive polymer wrapped carbon nanotubes could effectively facilitate the transeterification for stress relaxation and endow vritrimers with enhanced electrical conductivity. The vritrimer network was formed by curing epoxy with citric acid, in the presence of polypyrrole wrapped carbon nanotubes (CNT/PPy) as dopant. The transesterification performance, evaluated by stress relaxation analysis, showed 3.6 times faster relaxation rate, reduced transesterification activation energy and 15 °C lower T_v, after doping with only 3 wt% of CNT/PPy. The improved transesterification in stress relaxation, benefited from the higher thermal conductivity of carbon nanotubes and the interfacial interaction between CNT/PPy and vitrimer matrix. In contrast, pure CNT as dopant results in little enhancement suffering from strong agglomeration in the matrix. Tensile fracture analysis suggested the major role of π-π and p-π conjugation in the doping enhancement. In addition, CNT/PPy doping improved the conductivity for several orders of magnitude. This work provides a promising method for lowering temperature of transesterification and fabricating vitrimers with improved performance and extended applications.