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High Dimensional Stability and Low Viscous Response Solid Propellant Binder Based on Graphene Oxide Nanosheets and Dual Cross-linked Polyurethane

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Abstract

This work describes the fabrication, characterization, and deformation behavior of graphene oxide (GO) filled dual cross-linked polyurethane (PU) nanocomposites serving as solid propellant binder. The composites were synthesized through attaching isophorone diisocyanate onto GO nanosheets and cross-linking the modified GO (MGO) with PU chains. This methodology leads to uniform dispersion of MGO and its strong interface adhesion with matrix. The coefficient of thermal expansion (CTE) of the composites is tuned to the value of 150 ppm/°C, and reduced by 38.8% compared to neat PU. Moreover, both coefficient of energy dissipation and residual strain are linearly reduced, and the deformation recovery capability is specifically increased. Loss tangent ($\tan \delta$) shows the low dynamic viscous behavior, suggesting strong dependence on MGO content. Besides, the composite with 1.0 wt% MGO exhibits a critical point, where the transition from solid-like to liquid-like behavior nearly disappears. This study provides an achievable and important way to prepare the high-performance polymeric composite with prominent deformation properties.

Keywords: A. Polymer-matrix composites; B. Surface treatments; B. Mechanical properties; C. Deformation

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