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Construction and non-linear viscoelastic properties of nano-structure polymer bonded explosives filled with graphene

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ABSTRACT

The 1,3,5-triamino-2,4,6-trinitrobenzene (TATB)-based polymer bonded explosives (PBXs) modified with different contents of graphene from 0.05 wt% to 0.5 wt% were prepared by the water suspension methods. The non-linear viscoelastic properties of the TATB-based PBXs were detailedly investigated. The experimental results indicated that with the incorporation of only a small amount of graphene, the storage modulus, the static mechanical properties, and creep resistance in the nanocomposites were effectively improved. A rigid filler effect and the strong sheet/polymer matrix interfacial interaction to restrict the mobility of polymer chains played an important role in the enhanced non-linear viscoelastic behaviors of nanostructured materials. The formation mechanisms were further interpreted based on the modeling of the creep behavior using a six-element mechanical model. The modeling results demonstrated that the introduction of the graphene into the TATB-based PBXs was an effective and fundamental method to enhance the elastic modulus of high elastic deformation and restrain the irrecoverable deformation of the materials. The long-term

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