Accepted Manuscript

High dimensional stability and low viscous response solid propellant binder based on graphene oxide nanosheets and dual cross-linked polyurethane

Xiao Zhang, Jian Zheng, Haoming Fang, Yafei Zhang, Shulin Bai, Guansong He

PII: S0266-3538(17)33307-9

DOI: 10.1016/j.compscitech.2018.04.012

Reference: CSTE 7174

To appear in: *Composites Science and Technology*

Received Date: 31 December 2017

Revised Date: 2 April 2018

Accepted Date: 10 April 2018

Please cite this article as: Zhang X, Zheng J, Fang H, Zhang Y, Bai S, He G, High dimensional stability and low viscous response solid propellant binder based on graphene oxide nanosheets and dual cross-linked polyurethane, *Composites Science and Technology* (2018), doi: 10.1016/j.compscitech.2018.04.012.

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

Xiao Zhang [a, b], Jian Zheng [a, *], Haoming Fang [b], Yafei Zhang [b], Shulin Bai [b, *], Guansong He [c]

[a] *Mechanical Engineering College, Shijiazhuang 050003, China*

[b] *Department of Materials Science and Engineering, HEDPS/CAPT/LTCS, Key Laboratory of Polymer Chemistry and Physics of Ministry of Education, College of Engineering, Peking University, Beijing 100871, China*

[c] *Institute of Chemical Materials, CAEP, Mianyang, 621900, China*

* Corresponding author: Tel: +86-311-87992929, E-mail address: zhengj2020@163.com (J. Zheng); Tel: +86-10-62759379, E-mail address: slbai@pku.edu.cn (S.L. Bai)

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 δ) 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