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Xian-ling Xu, Chao-jin Yang, Jing-hui Yang, Ting Huang, Nan Zhang, Yong Wang, Zuo-wan Zhou

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Excellent dielectric properties of poly(vinylidene fluoride) composites based on partially reduced graphene oxide

Xian-ling Xu, Chao-jin Yang, Jing-hui Yang, Ting Huang, Nan Zhang,

Yong Wang*, Zuo-wan Zhou

School of Materials Science and Engineering, Southwest Jiaotong University, Key Laboratory of Advanced Technologies of Materials, Ministry of Education of China, Chengdu 610031, P. R. China

Abstract: In this work, poly(vinylidene fluoride) (PVDF)/graphene oxide (GO) were prepared through a two-step processing procedures, i.e. solution compounding and subsequent melt compounding processing. The thermal reduction of GO during the sample preparation process, the dispersion state of GO in the composites, and the crystallization of PVDF matrix were comparatively investigated. The results demonstrated that the partially reduced GO could be obtained during the sample preparation process. The residual oxygen-containing groups induced the crystal transformation of PVDF matrix from α-form to β-form on one hand. On the other hand, there was specific interfacial interaction between oxygen-containing groups of GO and $>CF_2$ group of PVDF matrix. The PVDF/GO composites were still insulated. High dielectric constant and low dielectric loss were achieved for the PVDF/GO composites with GO content higher than 1 wt%. The mechanisms for the excellent dielectric properties were proposed to be related to the interfacial polarization of the partially reduced GO, the formation of polar β-form PVDF crystallites and the formation of local GO network structure.

Keywords: A. Polymer-matrix composites (PMCs); B. Microstructures; B. Electrical properties

1. Introduction

Polymer composites with high dielectric constant and low dielectric loss exhibit great potential application in many fields relating to the charge storage and application due to their intrinsic characteristics, including the relatively low density, high compression strength, good processing ability, and relatively low equivalent series resistance, etc. Dielectric constant is related to the polarization of polymer in the electric field and generally, the higher the degree of the polarization

* Corresponding author: Tel: +86 28 87603042;
E-mail: yongwang1976@163.com