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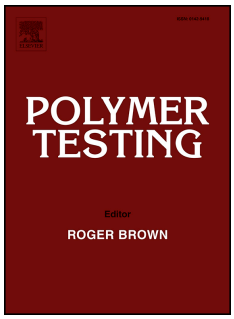

Effects of novel polyhedral oligomeric silsesquioxane containing hydroxyl group and epoxy group on the dicyclopentadiene bisphenol dicyanate ester composites

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Effects of Novel Polyhedral Oligomeric Silsesquioxane Containing Hydroxyl Group and Epoxy Group on the Dicyclopentadiene Bisphenol Dicyanate Ester Composites

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Abstract: Two types of novel Polyhedral Oligomeric Silsesquioxanes respectively containing hydroxyl group and epoxy group (P-POSS and E-POSS) were achieved and evaluated. The structure had been characterized by IR spectra and NMR spectra. Dicyclopentadiene bisphenol dicyanate ester(DCPDCE) composites were then prepared using P-POSS and E-POSS respectively. Their effect on the curing kinetics, dielectric, mechanical, flame-retardant and thermal properties and water absorption of the resulting composites were investigated. The results suggested that the addition of modified POSS could facilitate the curing reaction of DCPDCE. Besides, the DCPDCE composites containing modified POSS exhibited excellent flame-retardant property over pure DCPDCE resin. Adding only a little amount as small as 1.5 wt% P-POSS or 2.5 wt% E-POSS could change the UL-94V of DCPDCE resin from V-2 to V-0. The composite with P-POSS exhibited better flame-retardant and thermal properties than the composite with E-POSS. However, composite filled with E-POSS presented better dielectric property and lower water absorption.

Key Words: Flame-retardant property, polyhedral oligomeric silsesquioxane, hydroxyl group-containing, epoxy group-containing, Dicyclopentadiene bisphenol dicyanate ester

1. Introduction

Cyanate ester (CE) resin is one of the most important types of thermosetting polymers. It is used extensively as radomes, adhesives, high frequency numeric printed circuit boards and the matrix resin in structural composites for aircraft and in high temperature encapsulation due to its high thermal stability, good mechanical property, excellent dielectric property and superior moisture resistance, etc[1-3]. In many literatures, cyanate ester has been found that it can react with electron-rich compounds (such as compounds containing -NH_2, -COOH, -OH and epoxy group) and form triazine[4], polyisoureas[5], B–T resin[6, 7] and oxazolidone[8]. Despite numerous advantages, its performance of flame retardancy can't satisfy the requirement of the use of cyanate ester as an electronic material, and the brittleness resulting from stiff network of triazine groups and the resulting high crosslinking density restrict its applications in great degree. So it's imperative to modify and toughen cyanate ester resin matrix materials. Up to now, many researchers have reported multiple ways to improve the performance of CE by employing different types of fillers, for example, layered silicates[9, 10],grapheme nanosheets[11, 12], carbon nanotubes[13, 14], polysiloxanes[15, 16].

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