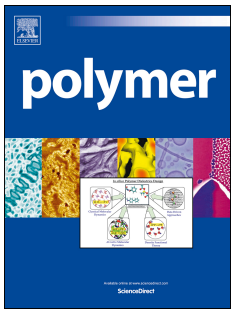
Accepted Manuscript



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PII: S0032-3861(17)31205-3

DOI: 10.1016/j.polymer.2017.12.035

Reference: JPOL 20224

To appear in: *Polymer*

Received Date: 13 September 2017

Revised Date: 10 December 2017

Accepted Date: 12 December 2017

Please cite this article as: Ding R, Torres SW, Messman J, Bowen DE, Bowler N, Dynamics of model polycyclic aromatic hydrocarbon compound-epoxy composites: A dielectric study, *Polymer* (2018), doi: 10.1016/j.polymer.2017.12.035.

Dynamics of model polycyclic aromatic hydrocarbon compound-epoxy composites: A dielectric study

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ABSTRACT

A model polycyclic aromatic hydrocarbon (PAH) compound, anthracene, was incorporated into a thermosetting epoxy matrix as a reinforcing moiety via physical dispersion and/or chemical modification. In order to understand the "additive effect" of glass transition temperature (T_g) observed with the variation of free anthracene (AN) and bonded 2-aminoanthracene (2-AM) loading, the relaxation dynamics were investigated by broadband dielectric spectroscopy. Within the measurement range of 0.01 Hz to 1 MHz and -60 to 130 °C, three relaxation processes, namely normal mode (n-mode) relaxation, α relaxation, and β relaxation, were observed for all epoxy composites with bonded and/or unbound anthracene. After eliminating the strong effect of ionic conduction by using the logarithmic derivative approximation $\varepsilon'' \propto \partial\varepsilon'/\partial \ln \omega$, derived from the Kramers-Kronig relations, the n-mode relaxation occurring at low frequencies above T_g for the rigid epoxy system is revealed. The Arrhenius diagram showing the temperature dependence of each relaxation process for the PAH-epoxy composites was obtained after parametric fitting using the Havriliak-Negami (HN) function in the frequency domain. The segmental α relaxation was more strongly impacted than