Electron spin resonance spectroscopy investigations of carbon nanotubes - natural rubber based nanocomposites

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Majority of polymers, possess no intrinsic paramagnetism and therefore do not give rise to an ESR spectrum. However, it is possible to apply this technique. One of the ways is to reinforce the polymer matrix by filler particles which already give rise to a resonance ESR spectrum. For different allotropes of carbon, including carbon nanotubes resonance spectra located close to the free electron g-value (g_0=2.0023) were reported.

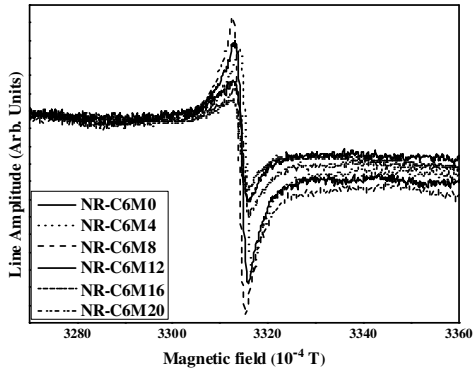

Figure 1: The ESR spectra, normalized to weight, of 6 phr multiwalled carbon nanotubes dispersed in NR based samples containing different content of EOMt, at room temperature

In this study elastomer based hybrid nanocomposites containing multi walled carbon nanotubes (MWCNT) and expanded organomodified montmorillonite (EOMt) were investigated by ESR spectroscopy by analyzing the resonance spectra obtained due to the presence of MWCNT in the nanocomposites. The ESR spectra of 6 phr MWCNT in NR-based nanocomposites containing different quantities of EOMt are shown in Figure 1. Narrow, symmetrical, and intense lines are observed. These Lorentzian shapes of the resonance spectra prove the good dispersion of the nanotubes within the NR matrix [1], regardless of the presence of EOMt. On the other hand, the established dependence of the double integral of resonance spectra on the amount of EOMt showed a sharp decrease when quantities higher than 12 phr are introduced into the matrix. This suggests that above a certain amount of EOMt, present in the matrix, a synergism engenders between these two nanofillers, EOMt and MWCNT.

References

[1] Chipara et. al., J. Optoelectron. Adv. M. **8**, 820 (2006).

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