**The effect of cross-linking system and reinforcement on the cross-linking reaction of peroxide vulcanized ethylene-propylene-diene terpolymers (EPDM)**

**P. Ketikis\*, I. Ketikis, D. Korres, P.A. Tarantili**

Polymer Technology Lab., School of Chemical Engineering,

National Technical University of Athens, Athens, Greece

*(\*ketikis.panayiotis@gmail.com*)

**ABSTRACT**

Ethylene-propylene-diene terpolymer (EPDM) is a synthetic rubber used in many industrial applications (automotive sealings, sidewalls of tires, insulators, sensors etc.). The concentrations of the vulcanization agent (dicumyl-peroxide, DCP) and the co-agent (triallyl-cyanurate, TAC) which consist the vulcanization system, affect the crosslinking procedure and the final 3-D cross-linked structure of the elastomer [1]. Carbon-based nanofillers, such as carbon black, graphene and carbon nanotubes (CNTs), are usually incorporated to EPDM in order to achieve enhanced thermal stability, tensile strength and good dielectrical properties, which are required in many state-of-the-art applications. Carbon nanotubes are one-dimensional nanostructures with exceptional mechanical, thermal and electrical properties, which are of relevance for research as reinforcing agents of elastomers. In this work, the effect of DCP (2, 5 & 8 phr), ΤAC (2, 4 & 6 phr) and CNTs (5, 8 και 10 phr) on the crosslinking reaction of EPDM was investigated. Differential scanning calorimetry (DSC) was employed in order to study the crosslinking reaction, based on the exothermal vulcanization peaks of isothermal (at 160, 170, 180, 190 oC) and non-isothermal experiments (with heating rates 5, 10, 25, 50 oC/min) [2]. The autocatalytic model was successfully applied to the results of isothermal experiments and the activation energy (Ea) of the reaction was calculated, based on the Arrhenius equation. The Ozawa-Kissinger equations were applied to the data obtained from the non-isothermal study. From the results based on isothermal DSC experiments, an increase was observed in the reaction rates and a decrease in Ea with the increase of DCP content, whereas a proportional relation between TAC content and the enthalpy and Ea of the reaction was recorded [3]. The incorporation of CNT’s in EPDM increased the Ea, in comparison with the unreinforced elastomer. From the non-isothermal DSC experiments, a significant increase in the enthalpy and Ea of the crosslinking-reaction was observed at higher DCP content. TAC content did not seem to have any obvious effect in the reaction. Based on the results of this research it is concluded that the increase of peroxide content facilitates the vulcanization of EPDM, whereas inhibition was observed by the incorporation of CNT’s reinforcement.

**KEYWORDS:** EPDM, Carbon nanotubes, Peroxide, Vulcanization, DSC

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