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STUDY OF RADIATION INDUCED STRUCTURAL CHANGES IN NITRILE RUBBER.

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Copolymers of butadiene (BD) and acrylonitrile (AN) (NBR rubber), have become important commercial material[1] . NBR rubbers are part of a larger classification of products often referred to as special-purpose rubbers. Oil resistance is the most important property of nitrile rubbers, and refer to the ability of the vulcanised product to retain its original physical properties such as modulus, tensile strength, abrasion resistance and dimensions, while in contact with oils and fuels.

Despite these reported advantages very few studies have been conducted[2] on the radiation yields and structural changes in nitrile rubbers during exposure to high energy radiation. In this study we are investigating the stability against gamma and UV radiation, to different doses in vacuum, of butadiene, acrylonitrile and NBR copolymers with different composition ratio BD/AN.

The mechanism of radiation induced structural changes is being investigated using experimental techniques such as ESR, NMR (Solid-state), FT-IR, RAMAN and UV spectroscopy. Also is being investigated the effect of irradiation on the mechanical properties of stressed and unstressed samples by TGA, DSC, DMA, Instron and Creep Test measurements.

So far the main effect have been a marked radiation-induced loss of unsaturation in the butadiene units, cis to trans isomerization and formation of crosslink structures (intermolecular and intramolecular).

One of the main challenges in the studies of NBR polymers is to observe directly the crosslinks produces by the radiation induced chemical reactions. IR spectroscopy is unsuitable because of the low molar absorvity of the peaks related to intermolecular crosslinking and the overlapping of the peaks (1630-1670 cm-1) related to intramolecular crosslinking (cyclization), with conjugated and nonconjugated (-C=C-; -C=N-) double bonds. A. K. Whittaker[3] has shown that crosslink structures in PBD can be detected and measured directly using solid-state ^{13}C NMR. This technique, and others, will allow us to detect and quantify the radiation induced chemical effects in nitrile rubber.

REFERENCES.

1. H. H. Bertram, *Develop. Rubber Technol.*, 2, 51 (1981).
2. T. G. Degteva and N. I. Pak, *Polymer Science*, URSS, 29 (8), 1750 (1987).
3. James H. O'Donnell, A. K. Whittaker, *A Solid-state ^{13}C NMR study of crosslinking PBD by γ-radiation*, J. Polymer Science, 30, 185-195, (1992).