Indian Journal of Natural Rubber Research, **6** (1&2) : 55-62, 1993

INVESTIGATIONS ON THE REINFORCEMENT MECHANISM OF SILICA FILLED EPOXIDISED NATURAL RUBBER : A DYNAMIC MECHANICAL APPROACH

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Varughese, S. and Tripathy, D. K. (1993). Investigations on the reinforcement mechanism of silica filled epoxidised natural rubber : A dynamic mechanical approach. *Indian Journal of Natural Rubber Research*, 6 (1 & 2) : 55-62.

50 mol per cent epoxidised natural rubber (ENR 50) was evaluated for its chemical interaction characteristics with precipitated silica with the help of rheometric studies and dynamic mechanical analysis. Isothermal dynamic mechanical properties were also studied for silica filled ENR in the presence of a silane coupling agent . Chemical interaction between silica and ENR was found to be high in the absence of any conventional curing aids.

Key words : Epoxidised natural rubber, Silica, Chemical interaction, Dynamic mechanical properties.

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INTRODUCTION

Natural rubber (NR) is well known for its superior gum strength, compared to most synthetic elastomers, due to its stereoregular structure. Epoxidised natural rubber (ENR) which has been recently introduced commercially also retains the stereoregular structure and its capacity to undergo strain induced crystallization, even after 50 mol per cent epoxidation. However, since the epoxy groups are highly vulnerable to acid catalysed ring opening and oxidation reactions in the presence of sulphur, the strength properties of ENR are slightly inferior to those of NR (Davies *et al.*, 1983; Baker *et al.*, 1985; 1986). On the other hand, the combination of qualities like oil resistance, air impermeability, damping and adhesion makes ENR superior to many synthetic elastomers and unmodified NR (Gelling and Morrison, 1985; Perera, 1990; Gelling, 1985; Varghese *et al.*, 1990). In addition to this, ENR is proved to be a chemically reactive rubber, which can crosslink with other functional polymers such as polychloroprene, chlorosulphonated polyethylene, poly (vinyl chloride) carboxylated nitrile rubber etc. (Mukhopadhyay *et al.*, 1990; Alex *et al.*, 1991; Ramesh and De, 1991). The ability of the epoxy groups for such chemical reactions prompted the present investigation to find out the special interaction mechanism responsible for the high reinforcement of ENR by silica. The active silanol groups on silica surface are known to interact with functional polymers like carboxylated nitrile rubber (Chakraborty and De, 1982). Physical properties of silica filled ENR showed that there is a marked difference in the interaction mechanism of ENR with silica