

## STUDIES ON CARBON BLACK FILLED SELF-VULCANIZABLE EPOXIDISED NATURAL RUBBER/POLYCHLOROPRENE BLEND

Functionally active rubbers are reported to undergo vulcanization by reaction between functional groups, without the aid of any extra vulcanizing agent. Such rubber blends are designated as self-vulcanizable. Blends of epoxidised natural rubber (ENR) and carboxylated nitrile rubber (XNBR) (Alex et al, 1990) and ENR and chlorosulphonated polyethylene (Hypalon) (Mukhopadhyay *et al.*, 1990) are self-vulcanizable. Epoxy resins can cure elastomers like polychloroprene (CR) (Zakharov and Maierov, 1963) and XNBR (Chakraborty, 1982). Miscibility of polychloroprene and ENR has been shown to be due to specific interaction between the chlorine atom and the oxirane ring (Nagode and Roland, 1991). As a result a binary blend of ENR and CR crosslinks when heated at high temperatures. This communication deals with the miscibility aspects and technical properties of carbon black filled binary blends of ENR and CR.

Polychloroprene rubber with 1.5 per cent chlorine in an allylic form (Neoprene AC) was procured from DuPont, USA. ENR with 50 mol per cent epoxidation was obtained from the Malaysian Rubber Producers' Research Association, U. K. The mixes (Table 1) were prepared on a 15cm x 35cm two-roll mixing mill. Both ENR and CR were individually masticated to the same viscosity and then blended for a further period of about 6 min. The filler, ISAF black, was added to the blend and the mixing continued for 7 min. Cold water

was circulated through the rolls to keep the roll temperature low. The blends were vulcanized at 180°C for 60 min. Physical properties and cure characteristics were determined as per the relevant ASTM standards.

Table 1. Formulations of rubber mixes

|                                 | N   | E    | NEa | NEb | CNEa | CNEb |
|---------------------------------|-----|------|-----|-----|------|------|
| CR                              | 100 | —    | 75  | 50  | 75   | 50   |
| ENR                             | —   | 100  | 25  | 50  | 25   | 50   |
| ISAF black (N 220)              | —   | —    | —   | —   | 20   | 20   |
| Na <sub>2</sub> CO <sub>3</sub> | —   | 0.25 | —   | —   | —    | —    |
| ZnO                             | 5   | 5    | —   | —   | —    | —    |
| Stearic acid                    | —   | 2    | —   | —   | —    | —    |
| MgO                             | 4   | —    | —   | —   | —    | —    |
| TMTD <sup>a</sup>               | —   | 1.6  | —   | —   | —    | —    |
| MBS <sup>b</sup>                | —   | 2.4  | —   | —   | —    | —    |
| Sulphur                         | —   | 0.3  | —   | —   | —    | —    |

a Tetramethylthiuram disulphide

b 2- (Morpholinothio) benzothiazole

Infrared spectroscopic (IR) analysis was done by a Perkin-Elmer spectrophotometer. IR spectra of neat ENR and CR were obtained using thin films prepared by dispersing the rubbers in low density polyethylene (LDPE). LDPE was first melted in a Brabender Plasticorder (PLE-300) and the elastomer sample was introduced to the molten LDPE, maintaining a blend ratio of 5.5:1. Thin films were prepared by pressing 0.75g of the melt