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STUDIES ON OZONE RESISTANCE OF NATURAL RUBBER — ETHYLENE/PROPYLENE RUBBER BLENDS

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The ozone resistance of blends of natural rubber (NR) and ethylene/propylene rubber (EPM) was quantitatively assessed in terms of critical stress-strain parameters. The effects of blend ratio and addition of carbon black and china clay on ozone resistance were also studied. It is observed that resistance of NR vulcanisates to ozone cracking is remarkably improved by blending it with EPM rubber. A blend ratio in the range of 80 : 20 to 70 : 30 NR : EPM is found to give adequate protection against ozone attack. Addition of high abrasion furnace (HAF) black improves ozone resistance of NR and the blends. Blending of HAF black masterbatches of the two polymers is beneficial only when the proportion of EPM is more than 30 parts per hundred rubber (phr). Addition of china clay reduces ozone resistance of natural rubber and the blends drastically.

Key words-- Ozone resistance, Polymer blends, NR/EPM blends, Masterbatch, Carbon black, China clay, Critical stress, Critical strain, Critical stored elastic energy density.

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INTRODUCTION

Among the external factors causing deterioration of rubber products, the most important ones are oxygen and ozone. Both these gases are present in the atmosphere, although the concentration of the latter is usually very low. While attack by oxygen is relatively slow and activated by heat, ozone attack is rapid. Hence even very low concentrations of ozone can cause cracks in rubber under strain. The degree of unsaturation of an elastomer is the most important factor determining its susceptibility to ozone attack.

There are several methods to protect an elastomer from ozone attack. The most common is the use of petroleum wax. Waxes give adequate protection as long as the product is subjected only to static conditions of exposure. Under dynamic conditions, wax film, being inextensible, ruptures leaving the elastomer unprotected (Lederer and Fath, 1981). Another method is the use of flexible coatings (Cutts and Wheelans, 1974). Polyurethane paints are the most promising among these. But both these methods provide only a physical barrier against ozone and are not suitable for dynamic applications. Hence the use of chemical antiozonants becomes more relevant as far as dynamic applications are concerned (Lake, 1970). But the disadvantage with chemical antiozonants is that they are highly staining and are likely to be lost during processing and service. Blending unsaturated elastomers