

CHAPTER - 1INTRODUCTION

For a number of years now most investigators have accepted the concept that vulcanization is caused by the formation of cross-bonds between long chain elastomers. Continuing studies of the chemistry of vulcanization are concerned with methods of formation of these cross-bonds, their chemical nature, their stability, and their relation to the mechanical properties of the vulcanizates. The idea of primary valence bonds between the chains has been well established. Apparently any chemical reaction capable of forming such bonds is an effective vulcanization process. Of these, most generally favoured and widely used vulcanization procedures today are basically elaboration of the original method of heating rubber with sulfur discovered by Charles Goodyear in 1839 and by Hancock in 1843; and this process still continues to be the basis of major technical usage of elastomers. Organic peroxides though known since 1915 to function as vulcanizing agents, but until recently no technically usable products have been produced by this means.

The properties of the vulcanizates are mostly influenced by the number and types of cross-bonds. For example, direct carbon to carbon bonds between the chains should be more rigid and more stable than a bridge of several sulfur atoms. The range of individual properties and the manner in which they can be balanced by

variation of various additives such as, accelerators, activators etc. indicates that at least two or may be more vulcanizing reactions are involved in such cases. It is also probable that, in any particular compound, properties depend on both specific reactions and the relative rates at which they occur.

In spite of the vast amount of work done all over the world in the last couple of decades it still remains a controversial problem and exact knowledge of the mechanism of reaction of sulfur with rubber both in accelerated and unaccelerated systems is still lacking. Stated more specifically, the vulcanization though accepted to be due to primary cross-bond, but the way its formation occurs still continues to be a matter of speculations. Recently, adopting rigorous kinetic analysis of the process and testing chemically the nature of such bonds investigators proposed radical or polar, or both types of reactions.

In the present study attention has been focussed primarily on 2-mercaptobenzothiazole, N-cyclohexyl-benzothiazole-2-sulfenamide, diphenylguanidine and tetraemethylthiuram disulfide accelerated sulfur vulcanization of natural rubber, both in presence and absence of zinc oxide and stearic acid. Dicumylperoxide which is known to be a potential cross-linking agent and a free radical donor has been used as a chemical aid for the elucidation of the mechanism of sulfuration with the above processes.