ABSTRACT

The present investigation deals with the detailed study of the failure properties of natural rubber and styrene-butadiene rubber vulcanizates mainly at high temperature and under swollen condition. The nature of rubber-filler interaction, the factors affecting it and their relation to properties are still not clear due to the complexity of the system. It is known that many factors like viscoelasticity, hysteresis, frictional heat loss, intrinsic strength, strain crystalline nature etc. contribute to the reinforcement of elastomer by filler. It is important to minimize some of the factors and study the effect of individual contribution on reinforcement. The goal is thus to understand the mechanism of reinforcement and the influence of the same on the failure properties of the vulcanizates when the network is weak and the factors like viscoelasticity are minimized. A detailed study has been carried out on the tear properties of NR and SBR vulcanizates mainly at high temperature and under swollen condition. Effect of carbon black on threshold tear strength has also been studied. Experiments on the same line has been done on tensile property. Emphasis has been given on the study of failure envelopes of carbon black filled rubber vulcanizates. To understand the mechanism of tear and tensile failure at high temperature and under swollen condition, microscopic examination of the failed surfaces of the rubbers has been

undertaken. In order to understand reinforcement mechanism and rubber-filler interaction in the absence of any chemical crosslinking, strain amplification factor of the unvulcanized carbon black filled rubber compounds has been studied over a wide range of temperatures. An extensive study of crack growth and fatigue behaviour of gum and filled rubber vulcanizates has been carried out at high temperatures. Effect of carbon black on dynamic mechanical properties of NR and SBR vulcanizates at high temperature and under swollen condition has also been investigated.

Keywords: Natural rubber, Styrene-butadiene rubber, Viscoelasticity, Hysteresis, Frictional heat, Intrinsic strength, Reinforcement, Threshold strength, Failure envelope, Strain amplification, Crack growth, Fatigue, Fractography.