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DYNAMIC MECHANICAL PROPERTIES OF SHORT SISAL FIBRE REINFORCED NATURAL RUBBER COMPOSITES

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The dynamic mechanical properties of natural rubber (NR) filled with untreated and chemically treated short sisal fibre have been investigated. By incorporating short sisal fibre the storage modulus (E') of NR vulcanizate was improved. The effect of fibre-matrix interface adhesion on the viscoelastic properties of the composite has been evaluated and it was found that interface adhesion increased the dynamic modulus and mechanical loss. The effects of fibre orientation, fibre loading and temperature on the dynamic mechanical properties have also been investigated. With increase in temperature, mechanical loss and modulus decreased sharply indicating a possible deterioration of the polymer at higher temperatures. The storage modulus (E'), loss modulus (E") and loss factor (tan δ) increased continuously with increase in fibre loading.

Key words : Natural rubber, Viscoelasticity, Composites, Short sisal fibre.

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INTRODUCTION

Reinforcement of rubber compounds with short fibres can be advantageous in products like hoses and beltings. Short fibre-elastomer composites combine the elastic behaviour of rubber with the strength and stiffness of the reinforcing fibre (O' Connor, 1977; Hamed and Coran , 1978 and Goettler and Shen, 1982). Short fibres can be easily incorporated into rubber and manufacturing operations do not involve complicated building techniques. Mechanical properties such as modulus, tensile strength, tear strength and ultimate elongation depend upon fibre and matrix (Coran *et al.* 1974).

Rubber products generally undergo dynamic stress during service. Therefore their behaviour under dynamic loading is highly important. Under such conditions bonding between fibre and rubber plays an important role in the performance of a short fibre reinforced rubber. But the factors affecting fibre rubber adhesion in such cases were not well understood. Derringer (1971) used short rayon, nylon and glass fibres in natural rubber to increase Young's modulus. Moghe (1976) reported the milling parameters which cause fibre orientation and its influence on the properties. According to Coran *et al.* (1794) the properties of cellulose fibre-elastomer composites depend on the type of elastomer used, fibre concentration, fibre aspect ratio and fibre orientation. O'Connor (1977) com-

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