

RHEOMETRIC STUDIES ON POLYBUTADIENE AND NATURAL RUBBER

Hema Acharya

Hema Acharya. (1988). Rheometric studies on polybutadiene and natural rubber. Indian J. Nat. Rubb. Res. 1(2): 22-29.

In this paper attempts have been made to describe how oscillating disk rheometric data are used to study the temperature coefficient and activation energy of vulcanization and, upto a certain extent, reaction kinetics for natural rubber (NR) and polybutadiene rubber.

A systematic study was conducted by selecting two carbon blacks namely HAF/ISAF, changing their dosage and sulphur to see their effect. The obtained data are compared with each other. It is observed that polybutadiene and natural rubber have got temperature coefficient of 1.75 to 1.80 in the temperature range of 135° to 170°C and activation energy value of 19 k cal mole⁻¹. The vulcanization reaction of polybutadiene rubber seems to be of first order.

Key words- Polybutadiene, Natural rubber, Activation energy, Vulcanization, Temperature coefficient.

Hema Acharya, Research Centre, Indian Petrochemicals Corporation Limited, Vadodara, Gujarat-391 346, India.

INTRODUCTION

Oscillating disk rheometers are widely used to test rubber stocks before processing. Rheometers monitor viscosity of the uncured stock, time to onset of cure, cure rate, completion of cure and the stiffness of the cured stock. Apart from this, it also gives indication about mixing and filler dispersion details. A review of available literature shows that apart from obtaining processing characteristics through rheometric curves, not much attention has been paid towards reaction kinetics and activation energy of vulcanization. (Fegade *et al.*, 1982; Mathur *et al.*, 1983; Pal and Basu, 1983; Pal *et al.*, 1983, 1984; Isayey and Deng, 1988). Attempts have been made in the present study to find out temperature coefficient and activation energy of vulcanization and, upto a certain

extent, kinetic data through rheographs. The temperature coefficient value is useful to find out curing time and curing rate when sufficient steam pressure is not available on the press. The activation energy value gives an idea about the vulcanization system and the kinetic data are useful for assessing reaction rate, etc.

EXPERIMENTAL

The characteristics of the rubbers used are given in Table 1 and the composition of the mixes in Table 2.

INTERNAL MIXING

The stocks were mixed in a BR model banbury mixer. The rotor speed was 77 rpm, ram pressure 4 kg cm⁻² and dump temperature 145°-150°C. The following mixing cycle was used (ASTM, 1973a, b).