Indian J. Nat. Rubb. Res. 4(1): 26-35, 1991

INFLUENCE OF TEMPERATURE ON COMPRESSION SET OF NR VULCANIZATES

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Mariamma George, K., Viswanathan Pillai, P. and Mathew, N. M. (1991). Influence of temperature on compression set of NR vulcanizates. Indian J. Nat. Rubb. Res. 4(1): 26-35.

Compression set (CS) of natural rubber vulcanizates was measured under different conditions. The temperature regime ranged from –30 to 70°C. The effects of cure system, filler, plasticizer and antioxidant on CS were also evaluated. At lower temperatures, peroxide-cured natural rubber showed higher CS than the conventionally cured rubber. Fillers, naphthenic oil and the antioxidant PBNA increased CS at all the temperatures studied.

Key words :- Natural rubber, Compression set, Cure system, Filler, Plasticizer, Antioxidant.

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INTRODUCTION

Set is a measure of recovery of a rubber specimen after removal of an applied stress or strain and that which occurs on compression is called compression set (CS). This is an important parameter influencing performance of seals, gaskets, and mountings made from rubbers and has been extensively studied. Jahn (1965) studied CS behaviour of some synthetic elastomers in comparison with that of natural rubber (NR). Baldwin (1970) developed a simplified model for CS and compared the results of high temperature CS of ethylene-propylene terpolymer (EPDM) rubber with the model. Improved CS resistance of a fluoro elastomer was reported by Moran and Pattison (1971). In most of these studies the test method employed was ASTM D 395, method B, with appropriate modifications. The test involves compression of a disc by 25 per cent of its thickness for a fixed time at a fixed temperature, followed by release at test temperature recovery for 30 min at room temperature and measurement of final thickness. The advantages and disadvantages of this test method were described by Turner and Loraine (1972). Although the test provides for measurement of set at any desired temperature, in the literature one normally finds CS data only at 20°C, 70°C and 100°C. However, for a proper evaluation of the set behaviour, a vulcanizate has to be tested over a wider range of temperature. For practical performance, CS both at low and at high temperatures will be of special interest. It is also quite likely that the ranking of rubber vulcanizates based on CS measured at a particular temperature may not hold good at another. In this context the extensive study by Jahn and Bertram (1973) on the CS behaviour of nitrile rubber over a wide range of temperature and the influence of compounding variables on set under such conditions, assumes importance. Although natural rubber is used in many engineering applications, data on CS behaviour at different temperatures are meagre. In the present investigation this aspect has been taken into account and CS of NR vulcanizates over the range of temperature from –30°C to 70°C has been