

STABLE FREE RADICAL ASSISTED MECHANICAL DEVULCANIZATION OF CARBON BLACK FILLED NATURAL RUBBER VULCANIZATES: ROLE OF CARBON BLACK FILLER

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The present paper describes the role of type and amount of carbon black filler present in the NR vulcanizates on the devulcanization efficiency and revulcanizate properties. NR vulcanizates filled with four different types of carbon black, N220 (20-25nm), N330 (26-30nm), N550 (40-48nm) and N660 (49-60nm) with varying particle size were used for the study. The original NR vulcanizates were mechanically devulcanized in a two roll mill, both in the presence and absence of a stable free radical, 4-Hydroxy TEMPO (4HT). In all the cases, the per cent devulcanization was significantly higher in stable free radical assisted devulcanization. The type of filler present in the vulcanizate does not seem to have a decisive role on the revulcanizate properties especially when stable free radical was used as a devulcanization aid. In 4HT assisted devulcanization of carbon black filled natural rubber, irrespective of the particle size of the carbon black filler used for the reinforcement of NR, the revulcanizate properties of the devulcanized rubber obtained were comparable with the original vulcanizate properties of the N660 filled NR vulcanizate. Studies on the effect of N330 content of the original sample upon devulcanization efficiency also revealed that the revulcanizate properties of the stable free radical assisted devulcanized samples were significantly better than that of the corresponding mechanically devulcanized samples.

Key words:, Vulcanization, Devulcanization, Stable free radical, Crosslink density

INTRODUCTION

Recycling of used rubber products has become an important matter of concern due to environmental, monetary and health issues. Devulcanization of used/end-of-life rubber products is a recycling strategy which aims at selective scission of crosslinks with minimal main chain scission, thereby ensuring better reuse of devulcanized rubber

as a raw material in the rubber industry itself.

The various devulcanization methods are recently reviewed by Joseph (Joseph *et al*, 2016a). Mechanical/mechano-chemical devulcanization processes which attempt to achieve devulcanization by the action of mechanical shear at ambient conditions, with or without the assistance of a chemical

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