PHYSICAL CHEMISTRY 2006

Proceedings

of the 8th International Conference on Fundamental and Applied Aspects of Physical Chemistry

September 26-29,
Belgrade, Serbia

ISBN	86-82139-26-X
Title:	Physical Chemistry 2006. (Proceedings)
Editors	Prof. dr A. Antić-Jovanović
Published by:	The Society of Physical Chemists of Serbia, Studentski trg 12-16, P.O.Box 137, 11001 Belgrade, Serbia
Publisher:	Society of Physical Chemists of Serbia
For publisher:	Prof. dr S. Anić, president of the Society of Physical Chemists of Serbia
Printed by:	"Jovan" Printing and Published Comp; 250 Copies; Number of Pages: x + 442; Format B5; Printing finished in September 2006.
Text and Layout:	Aleksandar Nikolić

250 – copy printing

CURE CHARACTERISTICS OF RECYCLED RUBBER POWDER FILLED STYRENE BUTADIENE /CHLOROSULPHONATED POLYETHYLENE RUBBER BLENDS

G. Marković[1], M. Marinovic-Cincović[2] and B. Radovanović[3],

[1]Tigar, Pirot, gmarkov@tigar.com
[2]VINČA Institute of Nuclear Science, Belgrade,
[3]Faculty of Science, Niš, Serbia

Abstract

The effect of recycled rubber powder (RRP) on cure characteristics of styrene butadiene and chlorosulphonated polyethylene rubber blends (SBR/CSM) was investigated in the concentration range of 0 to 20 phr. Results indicate that the minimum torque and Mooney viscosity of the SBR/CSM rubber blends increase with increasing RRP loading whereas the scorch time and cure time exhibit a decreasing trend. Increasing RRP loading also gives SBR/CSM rubber compounds reduces the elongation at break but the tensile stress, M 200 (stress at 200% elongation) increases slightly.

Introduction

Scrap rubbers are made up of rubber that does not meet processing and product specifications, leftover rubber from manufacturing activities and also old and defective rubber products. The scrap rubbers are waste and usually discharged. To reduce this pollution there is a need to recycles crap rubber [1]. Reclamation of scrap (vulcanized) rubber can be done by mechanical [2-3] and chemical processes [3-4]. Crane and Kay [6] have shown that scrap rubber vulcanisates could be depolymerized to a product known as “depolymerized scrap rubber”, which should be useful as a rubber compounding ingredient and as a fuel-oil extender. Styrene butadiene rubber has been studied and reported on extensively because of its superior performance in tire applications. Hypalon is a Chlorosulfonated polyethylene manufactured by DuPont, resistant to interactions with alcohol’s and strong acids and bases. The purpose of this study is to investigate the cure characteristics of recycled rubber powder (RRP) filled styrene butadiene/chlorosulphonated polyethylene (SBR/CSM) rubber blends.

Results and Discussion

Table 1. shows that increasing the recycled rubber powder loading in styrene butadiene and chlorosulphonated polyethylene rubber blends reduces the scorch time. This is because of the presence of cross-linked precursors and unreacted curative in the rubber powder[1-2]. The existence of unreacted accelerator in rubber powder waste has been reported by Mathew et al. [5].The other reason is diffusion of sulfur from the rubber matrix phase to the rubber powder phase, which lowers the concentration of sulfur in the rubber matrix [2-3]. Increasing the recycled rubber powder loading in SBR/CSM rubber blends also reduces the cure time t_{90} ,as shown in Table 1. Similar trends were

also observed by Baharin et al. [1], Ishiaku et al. [6] using different types and sizes of rubber powder particles.

The minimum torque, a measure of the stock viscosity, shows a slight increase with increasing rubber powder loading. This indicates that the processability of the compounds becomes a little more difficult . A similar observation can be seen in Fig. 1 for the Mooney viscosity of RRP filled SBR/CSM rubber blends at 140 °C.

Table 1. Curing characteristics of recycled rubber powder filled l styrene butadiene rubber/ chlorosulphonated polyethylene rubber blends

Curing characteristics	Rubber powder loading (phr)				
	0	5	10	15	20
Scorch time (min)	8	11	12	13.5	13.8
Cure time (min)	22	25	28	29	30
Cure rate index (CRI)	0.07	0.07	0.06	0.06	0.06

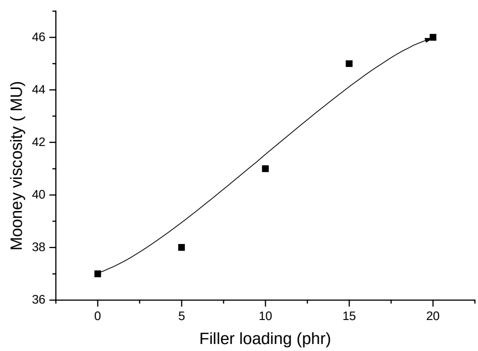

Fig. 1. Mooney viscosity of RRP-filled styrene butadiene rubber/ chlorosulphonated polyethylene rubber blends

Tensile properties

The tensile strength gradually increased to a maximum at 10 phr of rubber powder as shown in Tab. 2. As the rubber powder concentration increases, agglomeration and hence particle–particle interaction of the rubber powder also increases. The elongation at break of SBR/CSM rubber blends decreases with increasing recycled rubber powder loading. However, the decrease is small, particularly after 10 phr of recycled rubber powder loading. A similar observation was reported by Baharin et al. [1]. It can be seen that M 200 increase slightly with increasing recycled rubber powder.

Table 2. Mechanical characteristics of recycled rubber powder filled styrene butadiene rubber/ chlorosulphonated polyethylene rubber blends

Mechanical characteristics	Rubber powder loading (phr)				
	0	5	10	15	20
Tensile strength (MPa)	8	10	13..5	9	7.5
Elongation at break (%)	137	135	134	132	130
Modulus M 200 (%)	62	72	81	94	115

Conclusion

Cure characteristics such as scorch time and cure time of the styrene butadiene rubber/ chlorosulphonated polyethylene rubber blends increase with increasing recycled rubber powder loading but show slight decreases in CRI values. Tensile properties such as tensile modulus slightly increase with increasing recycled rubber powder loading whereas the elongation break shows a decreasing trend.

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