

RUBBER TECHNICAL DEVELOPMENTS LTD

(A development unit operated jointly by the British Rubber Producers' Research Association and the British Rubber Development Board)



BROADSHEET No. 4: CYCLISED RUBBER MASTERBATCH with Special Reference to its use in the Production of Resin/Rubber Shoe-soling Materials

The Technological Division of the British Rubber Producers' Research Association co-operated in the preparation of this Broadsheet and provided much of the data on which it is based.

INTRODUCTION

Cyclised Rubber Masterbatch is prepared by co-precipitating a blend of cyclised rubber latex and natural latex giving a material consisting of equal parts of cyclised rubber and natural rubber. It has powerful reinforcing properties, and enables products of low density to be produced with high modulus and hardness. Reinforced rubbers of pale colour can be produced with Cyclised Rubber Masterbatch and it blends readily with natural rubber in all proportions to produce vulcanisates of varying hardnesses. It is thus particularly suitable for the production of shoe-soling materials of the resin rubber types for both solid and microporous soles.



Cyclised Rubber Masterbatch as received from Malaya

CHARACTERISTICS

Appearance

Sheets baled as for natural rubber.

Colour

Brown. Can be pigmented to produce white vulcanisates.

Density

0.95

Processing

Mixes readily on open mill or internal mixer in a manner similar to natural rubber.

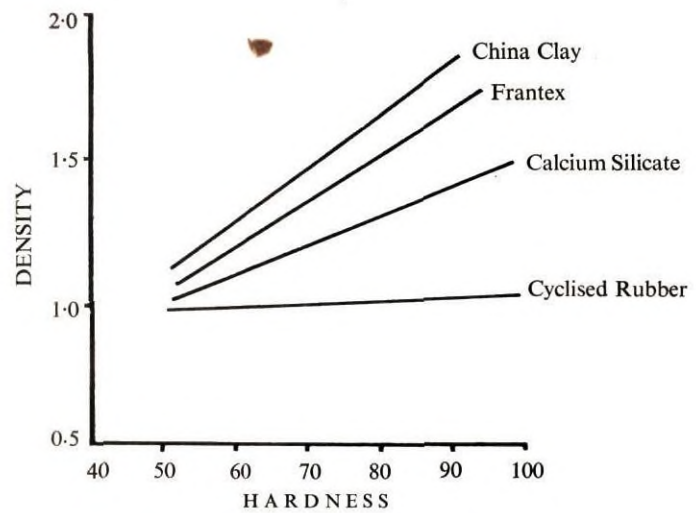
Vulcanisation

As for natural rubber with the usual vulcanising ingredients, under pressure or in open steam. Compounds have good flowing and moulding characteristics.

Compared with natural rubber products, the vulcanisates show some softening at elevated temperatures.

COMPARISON WITH FILLERS

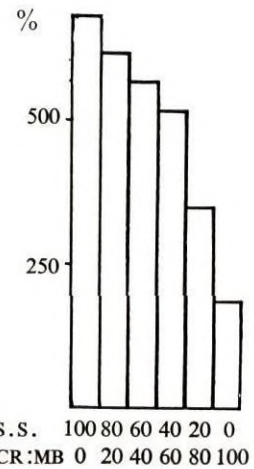
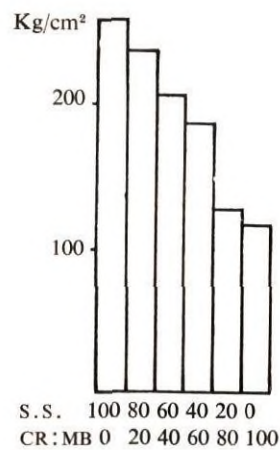
Graph Showing Densities
with increasing hardness
values in comparison with
mineral filler loading.



EFFECT IN PURE GUM COMPOUND

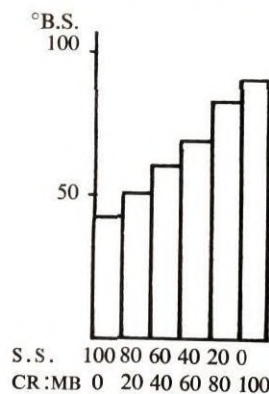
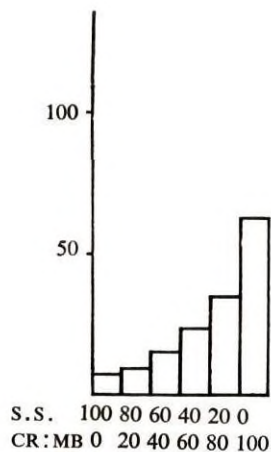
Base Mix

Rubber and/or Cyclised Rubber	100
Sulphur	2.5
Zinc Oxide	5
Stearic Acid	2
Santocure	0.7

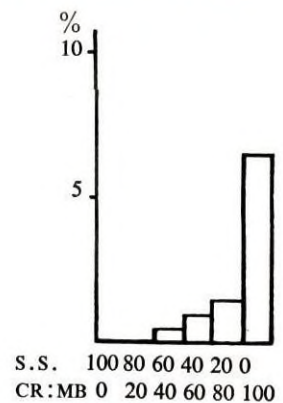


TENSILE STRENGTH

ELONGATION AT BREAK



HARDNESS



TENSION SET

MODULUS 100

SOLID SHOE-SOLING MATERIAL

By suitable compounding, first grade resin/rubber solings can be produced in sheet form for cut soles or in moulded sole form. The following recipes are suggested (figures give parts by weight):

	1	2	3
Cyclised Rubber Masterbatch	55	50	45
Smoked Sheet	45	50	55
Frantex B1	60	—	—
Tufknit CS	—	60	—
Manosil AS7	—	—	60
Zinc Oxide	5	5	5
Nonox HFN	1	1	1
Agerite White	0.8	0.8	0.8
Santocure	0.7	0.7	0.7
Stearic Acid	2	2	2
Yellow Ochre	3	3	3
Red Ochre	0.2	0.2	0.2
Sulphur	2.5	2.5	2.5

Mixing

Open Mill: The masterbatch is blended with the smoked sheet with minimum mastication, after which the other ingredients are incorporated as for usual rubber compounding.

Internal Mixer: Smoked Sheet + Masterbatch, followed by 50% of the filler and zinc oxide, followed by remainder of filler and zinc oxide, followed by stearic acid, colours, antioxidants and accelerator, followed by sulphur.

After dumping from the mixer the compound is passed twice through a tight nip on two-roll mill and sheeted off.

After 24 hours rest, the compound is re-sheeted and ready for cure.

Cure

8 mins @ 153°C. (or 20 mins @ 141°C.).

Test Results

	1	2	3
Tensile Strength (kgs/cm ²)	130	116	133
Modulus 100% (kgs/cm ²)	60	40	53
Elongation (%)	315	328	315
Tension Set (SATRA) (%)	10	4	4
Compression Set (%)	11	4	6
Cut Growth (SATRA) (mm/kcs)	6/175	2/150	5/150
Hardness (B.S. degrees)	93	91	93



Stuck-on through sole



Stitched through sole



Riveted half sole

MICRO-POROUS SHOE-SOLING MATERIAL

Mixing is carried out as for the solid soling, the blowing agent being added after the accelerators have been incorporated. The following recipes produce satisfactory products:

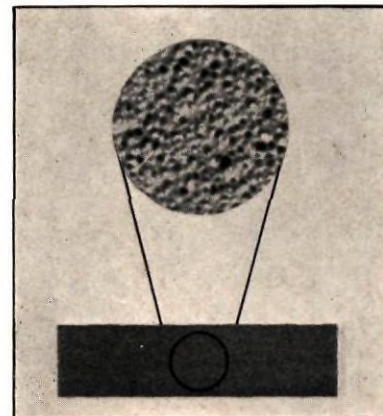
	4	5	6
Cyclised Rubber Masterbatch	30	40	75
Smoked Sheet	70	60	25
Frantex B1	40	60	—
Tufknit CS	—	—	60
Zinc Oxide	5	5	5
Nonox HFN	1	1	1
Agerite White	0.8	0.8	0.8
Santocure	0.7	0.7	0.7
Stearic Acid	2	2	2.5
Yellow Ochre	3	3	3
Red Ochre	0.2	0.2	0.2
Vulcacer B.N.	4	3	2
Cumarone Resin (Hard)	15	10	—
Sulphur	2.5	2.5	2.5

Cure

20 mins @ 141°C.

Test Results

	4	5	6
Density	0.6	0.8	0.94
Hardness (B.S. degrees)	41	56	85
Split Tear (SATRA) (lb./inch)	17	16	10
Cut Growth (SATRA) mm/kcs	5/400	6.5/400	8/400



*Micro-cellular soling material.
Actual size and 10-fold magnification*

OTHER APPLICATIONS

Although this publication is concerned mainly with the use of Cyclised Rubber Masterbatch for shoe-soling material, there are obviously many fields where cyclised rubber can be used to advantage. Rubber rollers to withstand pressure and friction, and which must not be black in colour, have been successfully prepared from cyclised

rubber, and have proved their great superiority over normal rubber rollers loaded with standard mineral fillers. Non-Black belting has also been produced which has given long service life. These are two of the applications where cyclised rubber has been used to produce a hard reinforced material without the incorporation of carbon black.

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