

# PHENOLIC RESINS FOR THE RUBBER INDUSTRY – AN OVERVIEW

The use of phenolic resin in the rubber industry as follows:

- i) Tackifying Resin
- ii) Reinforcing Resin
- iii) Curing Resin
- iv) Bonding Resin
- v) Adhesive Resins

## TACKIFYING RESIN:

The main difference between the Phenolic Resin and the other tackifying resins like Rosin-ester, Hydrocarbon, is the type of the bond strength on the surface of the Rubber Compounds. The General Tackifying resins form weak VanderWaal force through which the tackiness forms, whereas the Phenolic resins forms the strong Hydrogen bonds with the rubber surface.

- **Chemical Bond Formation**

- Occurs during vulcanization

- **Hydrogen Bonding**

- Formed by Phenolic resin tackifiers

- **van der Waals Forces**

- Weak intermolecular attraction improved by all tackifier resins



The advantage of PHENOLIC tackifiers over the other general purpose tackifiers are as follows:

- High initial Tack with Better Tack Retention.
- Better Heat and Humidity performance.
- Lower loading levels to achieve the same degree of tackiness in the rubber compounds which in turn gives the compounds comparatively less HEAT BUILD-UP.
- Acts as a process aid during mixing and is inert in the end product

**Note:**

The tackiness of the Rubber compounds will get reduced by the increase in the addition of fillers, however the tackiness in the compound will be increased by the addition of tackifying resins, whereas the increase in the oil also decrease the tackiness which cannot be further increased by the increase of the tackifying resins.

**SUPER TACKIFIERS:**

Super Tackifiers are the special type of Modified Phenolic resins used in the Rubber Compound to have the superior initial tack and tack retention for improved processing conditions with excellent scorch safety and imparts good tackifying properties in Hot and Humid conditions, and for ideal for imparting tackiness in the synthetic Rubbers.

PRODUCT FEATURES	IMPACT
HIGH INITIAL TACK	Improved building tack
Better Scorch Protection	Wider Processing conditions
Higher modulus without loss in rebound performance	Greater strength without heat buildup
Significantly better tack in hot and humid conditions	Much better performance under all conditions.

**REINFORCING RESINS:**

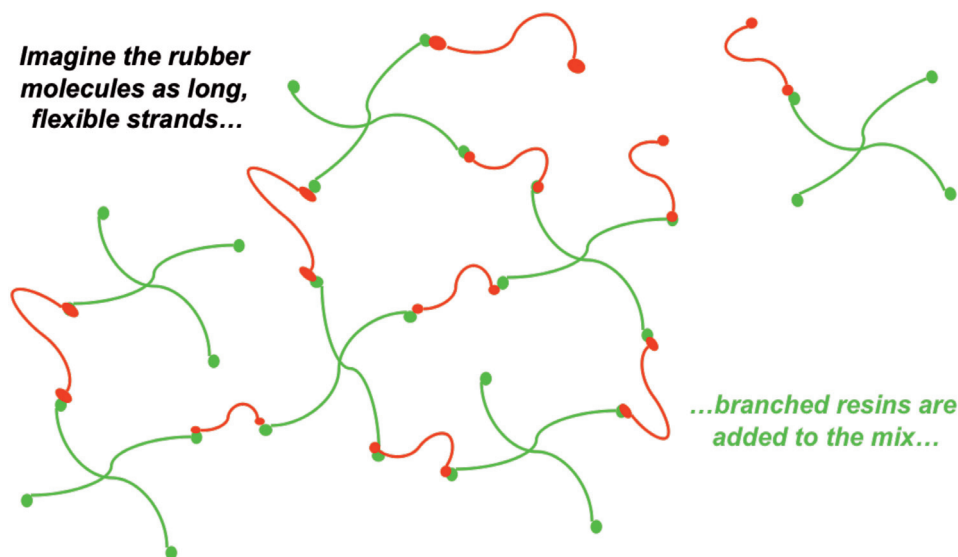
These type of reinforcing phenolic resins will undergo self-condensation reaction (will not cross-link with the rubber) in combination with curing agents (methylene donor such as hexamethylenetetramine or hexamethoxymethylmelamine). Often these type of resins is modified with tall oil or cashew nut shell liquid for solubility in rubber.

The hardness level of the vulcanised rubber materials obtained with phenolic reinforcing resins also similar to the rubber and fillers types as well as the resin/methylene ratio. (Normal methylene donor ratio is 7-8 parts of the resin dosage). This can be used either alone or in combination with the usual fillers.

These resins will improve the abrasion resistance, initial tear strength of the rubber products with better stiffness, toughness along with the reduced residual compression set, better heat, oil and solvent resistance.

Depends on the mixing temperature the type of the reinforcing resin (whether with or without methylene donor) is selected as the curing temperature of the methylene donor modified resins will get cured around 115 – 120 deg.C

Resin Type	NR	SBR	EPDM	NBR	CR
Cashew nut shell modified			R	R	R
Tall oil modified	R	R	R		



*...and crosslinked with methylene donor.*

The resulting mix is harder and tougher.

## PRODUCT RANGE FROM M/S.S.I. GROUP

### **Schenectady Products**

- SP-6700 – Cashew Nut Shell Oil Modified
- SP-6600 – with added methylene donor
- SP-6701 – Tall Oil Modified
- SP-6601 – with added methylene donor
- HRJ-11995 – Low free monomer
- SFP-169 – Not oil modified
- SFP-171 – Ultra clean, unmodified
- R-7559 – Alkyl phenol modified
- R-7545 – Mixed alkyl phenol based
- **R-7234 – SI Group Produced HMMM**
- **PR 108**

## CURING RESINS OR VULCANISATION RESINS:

These phenolic resins (Resole type) give the three-dimensional cross-linking considerably enhanced by carbon-carbon cross-linking which features excellent heat, steam, oxidation and ageing resistance in the

rubber compounds and are mainly used with Butyl rubber which exhibit relatively low degree of unsaturation. It acts as a plasticiser till curing and exhibits good and moisture & temperature resistance.

The three-dimensional cross-linking occurs through the use of the methylol and after the cleavage reaction, methylene ether groups of para-alkylphenol group reaction.

Curing resins are intended to crosslink unsaturated Elastomers and contains methylol or bromo-methyl groups for reactivity. It requires halogen donor or a Lewis acid for activation

## ***SI Group Products***

- **Non Brominated**
  - SP-1044
  - SP-1045
  - HRJ-10518
  - HRJ-14247A - SP-1045 Oil Solution
- **Brominated**
  - SP-1055
  - SP-1056

### **BONDING RESINS:**

These resins are used in Rubber compound along with the methylene donor to improve the adhesion between the rubber matrix and the surface of the metal or textile inserts. . It doesn't give the by-product as the free residual monomers which may have the influencing behaviour in the rubber compound, i.e. less fuming during the curing cycle of the rubber products.

These resins will give very high cross-link density, high reactivity, high modulus, good wire adhesion, near zero free resorcinol and excellent rubber-to-rubber knitting.

ELAZTOBOND SERIES will have these characteristics.

- **Elaztobond® A 150**
- **Elaztobond® A 250**

### **ADHESIVE RESINS:**

Adhesive Phenolic Resins can be sub-divided into Reactive resin and tackifying resins.

Reactive resins are alkylated phenol formaldehyde type and will react with Magnesium oxide. It provides high heat resistance and improve contactibility through crystallinity.

- SP-103: Longest Open Time
- FRJ-551: General Purpose
- SP-134: General Purpose
- HRJ-1367: Highest Reactivity
- HRJ-11331: Short Open Time, High Bond Strength
- SP-154: High Heat Resistance
- Rezilite™ 888: Low Color, Balanced Properties
- SFP-121H: Improved Heat Resistance & Adhesion
- SP-212P: Unique Purple Color
- SP-184: Extremely High Temp Performance

Tackifying adhesive resins are both terpene and alkylated phenol formaldehyde resins, which gives increased open time and improved green tack to the adhesives.

- SP-553: Medium MP Terpene-Phenolic
- SP-557: Low MP Terpene-Phenolic
- SP-558: Slightly higher MP than 557
- SP-560 : High MP Terpene-Phenolic
- SP 561 – Intermediate MP Terpene-Phenolic
- SP-1068 = R-7510: Low MP Phenolic
- HRJ-2765: Medium MP Phenolic

RESIN CLASSIFICATION	TYPE	GRADES OF S.I. GROUP
TACKIFYING RESINS	OCTYL PHENOL RESINS	SP 1068, R 7510, SMD 31161, HRJ 2765
	BUTYL PHENOL RESINS	R7572P, SMD31144, R7572P
	SUPER TACKIFIERS	SP 1077, T6000, T3100
	Terpene Phenolic	SP 553, SP 560
REINFORCING RESINS	Phenol Formaldehyde	HRJ 12952, SFP169, SFP118, SFP171, R7515P
	Tall oil modified	SP 6601, SMD 3644, SP1701, PR101
	Cashew Shell Nut Liquid modified	SP 6700, SP6600 (SP266), PR 108, HRJ1199552

RESIN CLASSIFICATION	TYPE	GRADES OF S.I. GROUP
BONDING RESINS	ELAZTOBOND A Resins	A150, A250, SRF 1524, 1501
CURING RESINS	OCTYL PHENOL RESINS	SP 1044, SP 1045, HRJ 10518, SP1055, SP1056, R7530E, PR209
	MELAMINE BASED	R7232, 7234,7235
ADHESIVE RESINS	REACTIVE TYPE	SP 103, SP212, SP134, SP154, SP 184, HRJ1367,HRJ11331,SFP121, FRJ551
	TACKIFYING TYPE	SP553,SP557,SP558,SP560,SP561,SP1068 (R-7510), HRJ2765

### Kindly Note:

All the grades mentioned in this news letter is being manufactured by M/s.S.I. GROUP.

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