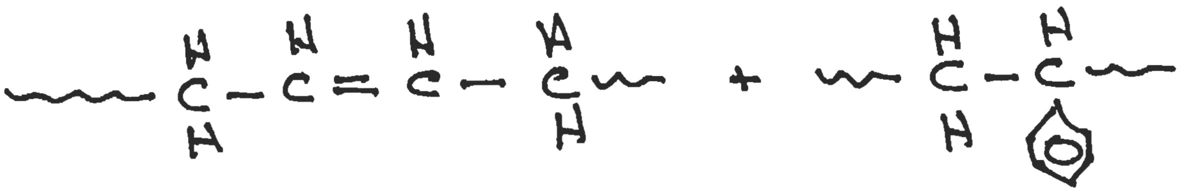
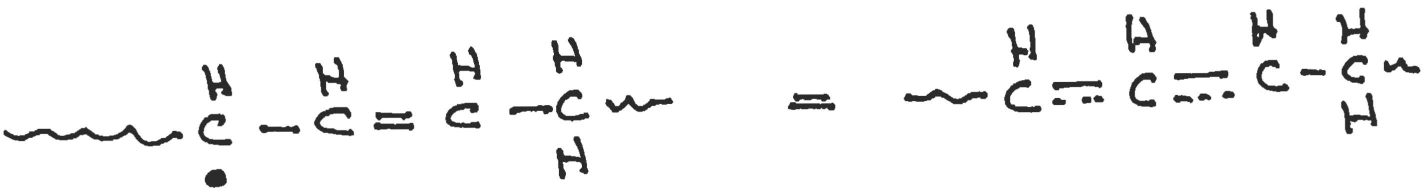
Thermoset Elastomers

SBR - styrene-butadiene rubber



Vulcanization:



"allylic" radical

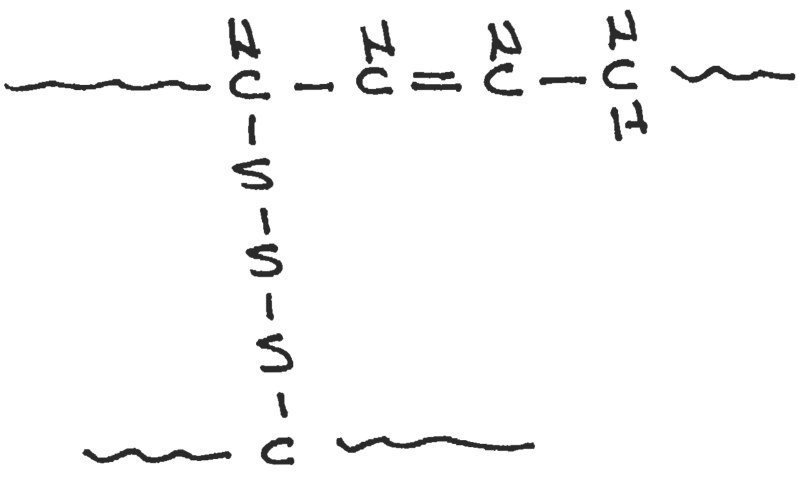


TABLE 2.1. TYPICAL TIRE TREAD RECIPES

Ingredient	*phr*[a] Natural Rubber	*phr*[a] Synthetic	Function
Smoked sheet	100	–	elastomer
Styrene-butadiene/oil masterbatch	–	103.1	elastomer-extender masterbatch
cis–polybutadiene	–	25	special purpose elastomer
Oil soluble sulfonic acid	2.0	5.0	processing aid
Stearic acid	2.5	2.0	accelerator-activator
Zinc oxide	3.5	3.0	accelerator-activator
Phenyl-beta-naphthylamine	2.0	2.0	antioxidant
Substituted N,N'–p–phenylene-diamine	4.0	4.0	antiozonant
Microcrystalline wax	1.0	1.0	processing aid and finish
Mixed process oil	5.0	7.0	softener
HAF carbon black	50	–	reinforcing filler
ISAF carbon black	–	65	reinforcing filler
Sulfur	2.5	1.8	vulcanizing agent
Substituted benzothiazole–2–sulfenamide	0.5	1.5	accelerator
N–nitrosodiphenylamine	0.5	–	retarder
Total weight	173.5	220.4	
Specific gravity	1.12	1.13	

[a]Parts per hundred parts of rubber, by weight.

Source: Morton, M. (ed.) *Rubber Technology*. 2nd ed. New York: Van Nostrand Reinhold, 1973: p.20

Kerimid High-Temperature Thermoset Resins

Kinetics:

$$(d\alpha / dt) = Z\exp(E/RT)(1-\alpha)^n$$

$$= (1/H_0)(dH/dt)$$

$$\alpha = \int (d\alpha/dt)\,dt$$

Freeman-Carroll Analysis

$$\log\dot{\alpha} = \log Z + \frac{E}{2.303RT} + n\log(1-\alpha)$$

Difference form:

$$\Delta\log\dot{\alpha} = \Delta\log Z + \frac{E}{2.303R}\Delta\left(\frac{1}{T}\right) + n\Delta\log(1-\alpha$$

Finite Element Analysis

$$\rho\left[\frac{\partial u}{\partial t} + u\nabla u\right] = -\nabla p + \nabla(\nu\nabla u)$$

$$\rho c\left[\frac{\partial T}{\partial t} + u\nabla T\right] = Q + \nabla(k\nabla u)$$

$$\left[\frac{\partial C}{\partial t} + u\nabla C\right] = R + \nabla(D\nabla u)$$