TECHNICAL UPDATE

CRAY VALLEY
Hydrocarbon Specialty Chemicals

Ricon® Resins and Functionalized Ricon® Resins Enhance Wire & Cable Rubber Compounds

Benefits

- Increased crosslink density
- Improved electrical properties
- Water resistance

Target Markets

- Wire & cable

Additional Information

MSDS/TDS: Ricon 154, Ricon 156 MA17

Description

Ricon® brand polybutadiene resins and functionalized polybutadiene resins have been shown to enhance the properties of wire and cable rubber compounds. High 1, 2-vinyl polybutadiene resins act as coagents to improve physical and electrical properties in EPM/EPDM and EVA/EVM rubber compounds. Also, functionalized polybutadiene resins are shown to improve the physical and electrical properties of CPE rubber compounds.

Ricon resins are very efficient cure coagents when peroxide curing a variety of mostly saturated elastomers. As polybutadiene-based resins, these coagents contribute to crosslink density while not significantly altering the polarity of the compound. They are more soluble in many elastomers than monomeric coagents and are also less prone to homopolymerization. These properties taken together result in a more uniform crosslink density and can lead to improved physical and electrical properties.

Features of the polybutadiene resins used in this study are shown in Table 1 below.

Table 1: Polybutadiene Resin Features

PRODUCT	Mn (g/mol)	1,2 Vinyl (%)	Viscosity (cps)	Tg (°C)	Used in Polymers:
Ricon 154	5,200	90	250,000 @ 45 °C	-15	EPDM, EPM, EVA, EVM @ 2 phr
Ricon 156 MA17	2,500	70	140,000 @ 25 °C	-25	CPE @ 3 phr

Lab size masterbatches were used in this study. The peroxide and coagents were mixed into these masterbatches on a two-roll lab mill at 50 °C, except for the EVA compounds which were milled at 100 °C. Compounds were sheeted, allowed to rest 24 hours, and then sampled for testing.

Control compounds without coagents were used for comparative purposes against compounds with coagents.

The most effective indicator of crosslink density is the delta torque measurement obtained from rheometric analysis. A direct relationship exists – higher delta torque means higher crosslink density. The polybutadiene coagent increased the delta torque in all rubber compounds compared to the control; these results are depicted in Figure 1 shown below.

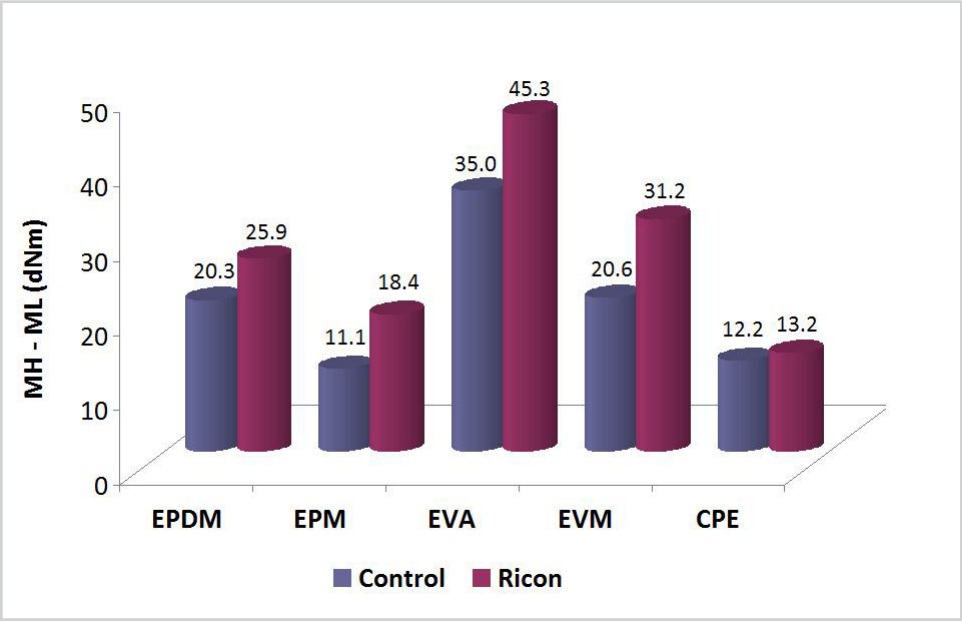


Figure 1: Effect of additive on crosslink density in various polymer compounds

Because water resistance is very important to electrical properties, the rubber compounds were immersed in distilled water for 166 hours at 82 °C. The polybutadiene coagent decreased the volume change in all rubber compounds. These results are depicted in Figure 2 shown below.

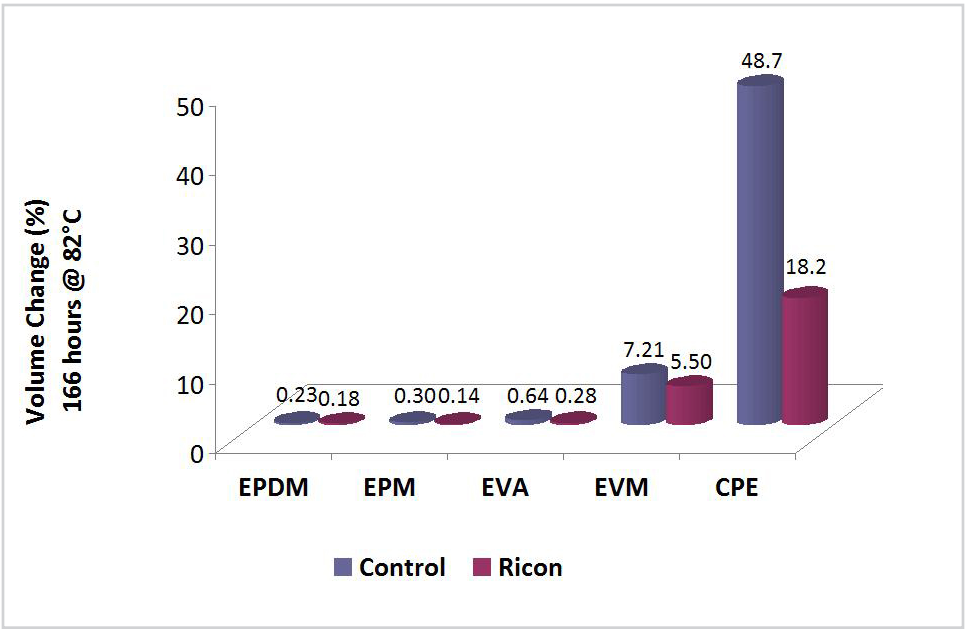
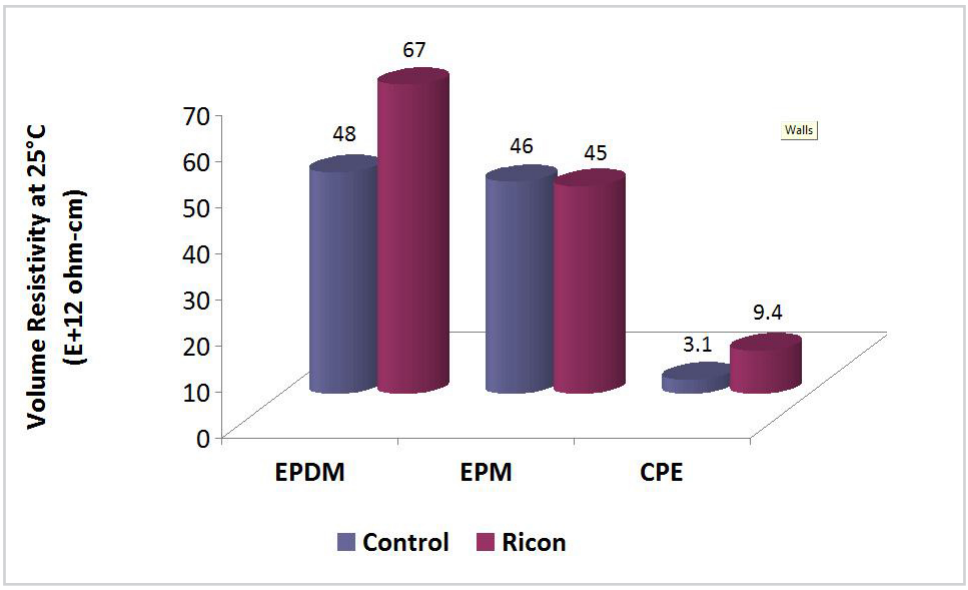


Figure 2: Effect of additive on water swell properties in various polymer compounds

Electrical properties are obviously very important for wire & cable compounds. Therefore, EPM/EPDM and CPE rubber compounds were sent to an independent laboratory for volume resistivity and dielectric strength testing. The polybutadiene coagent improved the electrical properties. These results are depicted in Figure 3 shown below.



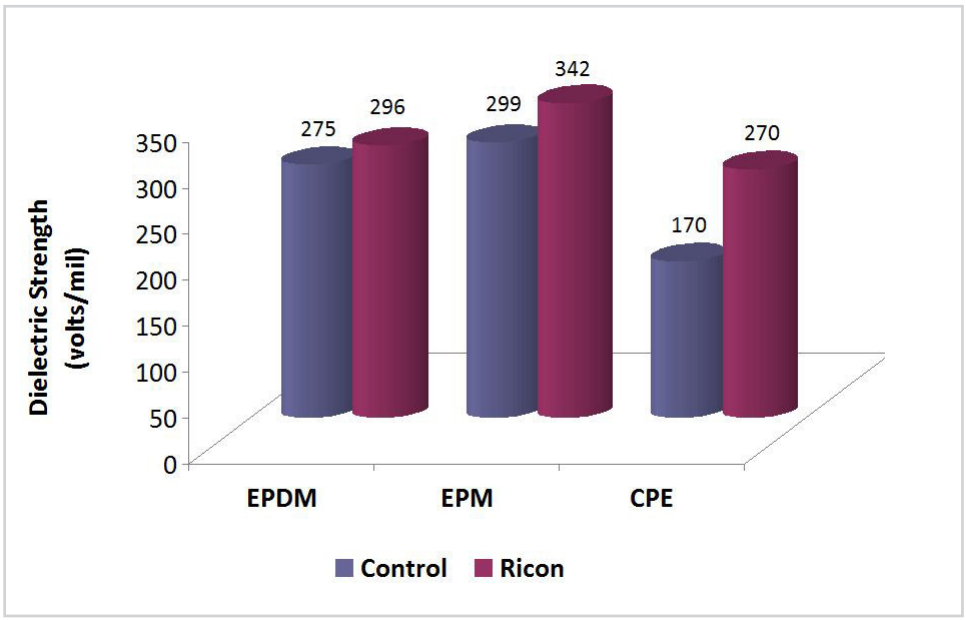


Figure 3: Effect of additive on electrical properties in various polymer compounds

Summary

The polybutadiene modified compounds provided improved crosslink density, water resistance, and electrical properties.

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Appendix

Table 2: Model Formulations

Ingredient	Loading (phr)				
EPDM (72% E, 6% D)	100				
EPM (65% E)		100			
EVA (18% VA)			100		
EVM (50% VA)				100	
CPE (36% C)					100
Ricon 154	2	2	2	2	
Ricon 156 MA17					3
N550 Carbon Black	35	35	2	45	35
Calcium Carbonate	105	105			150
Hydrated Alumina			75		
Red Lead (90%)	5.6	5.6			
Antioxidant	2	2	3	2	
Zinc Oxide	5	5			
Paraffinic Oil	25	25			
Stearic Acid			1	1	
Silane			1		
Magnesium Oxide				1	5
Polyethylene Wax				1	
Paraffinic Wax					2
Plasticizer					38
Dicumyl Peroxide (40%)	7	7			7
Butylperoxy-Di-Isopropyl Benzene (40%)			6	6	

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