TECHNICAL UPDATE

CRAY VALLEY
A BRAND OF TOTAL

BENEFITS

- Adhesion improvement of RFL
- Improved adhesion to EPDM peroxide-cured rubber

TARGET MARKETS/ APPLICATIONS

- Textile Treatment
- Belts
- Hoses

ADDITIONAL INFO

- **SDS/TDS:** Ricobond® 7004
- **Tech Update:** Ricobond 7004 for Improved Adhesion of PET to Peroxide-Cured EPDM

Ricobond® 7004 for RFL Adhesion Improvement

Description

Textile reinforcement is a common practice to enhance the overall performance of rubber goods. This performance depends on the adhesive bond between the textile and the rubber. To achieve sufficient bonding between the elastomer and reinforcement, a resorcinol formaldehyde latex (RFL) dip is typically used to treat the surface of the textile. Although RFL provides sufficient adhesion to a variety of substrates and elastomers, adhesion to ethylene propylene diene monomer (EPDM) rubber remains a challenge. Polyethylene terephthalate (PET) reinforced EPDM elastomers are widely used in many mechanical rubber applications such as belt and hose.

TOTAL Cray Valley has developed a series of aqueous dispersions of functionalized resins including Ricobond 7004 (RB7004). Table 1 lists the chemical and physical properties of Ricobond 7004. When mixed with other water-based emulsions, Ricobond 7004 can increase rubber adhesion to textiles and metals and improve chemical resistance. The hydrophobic and hydrophilic components of Ricobond 7004 allow for interaction between polar and non-polar substrates.

In addition to RF-free formulations, Ricobond 7004 can also be used as an additive to RFL for improved adhesion performance. In this study, Ricobond 7004 is blended with RFL and a carboxylated styrene butadiene (SB) to treat non-adhesive activated and adhesive activated PET cord. A proprietary peel test method was used to test adhesion of the cord to EPDM peroxide-cured rubber. Table 2 shows the rubber compound formula and additives.

Table 1: Physical and Chemical Properties of Ricobond 7004

Identification	Ricobond® 7004
Mn, g/mol	4500-5500
Functional Groups/Chain	11
Viscosity, cps @ 25 °C	<500
pH	8.0-9.0
Solids, wt%	28-31

Table 2: EPDM Rubber Compound Formulation

Material	phr
Nordel® IP 4640 EPDM	100.0
N 660 Carbon Black	80.0
Sunpar® 2280	45.0
Stearic Acid	1.0
Zinc Oxide	5.0
Dymalink® 634 Type I Coagent	5.0
Dicup 40 KE	7.0

Procedure and Testing

SAMPLE PREPARATION

A Litzler cord dipping machine was used to treat single end PET cords. For adhesive activated cords, a one-step dipping process was used to treat the cords. After dipping, the cords were passed through ovens with two temperature zones: 330 ˚F and 450 ˚F. For non-adhesive activated PET cords, a two-step dipping process was used. In the first step, the cords were dipped in a bath containing the primer and then passed through an oven at 450 ˚F. The cords were then dipped in the second dip and passed through two successive temperature zone ovens set to 330 ˚F and 450 ˚F, respectively. A standard formulation of the primer is shown in Table 3. The dips were made combining RB7004, SB latex and RFL (Table 4).

Table 3: Primer Formulation

Water	91.56
Blocked Isocyanate	6.96
Anionic Surfactant	0.12
Epoxy Resin	1.36
Total	100.0
Total Solids	5.1%

Table 4: Dip Formulations

Water
RFL
Ricobond® 7004
GenFlo® Latex (Carboxylated Styrene Butadiene)
Grilbond® IL-6

About 8phr IL-6 was added to the dips. The blends contained 9% RB7004, 37% SB and 54% RFL. The final composition of the blends was then diluted to 21% solids. The RFL dip was used as a control to treat the cords using the above dipping and drying process.

TESTING

The treated cords were molded into a sheet of rubber using a proprietary method to generate adhesion test specimens. An Instron instrument was used to test peel adhesion.

Results

The additions of Ricobond 7004 to RFL showed significant improvement in adhesion between non-adhesive activated (NAA) PET cord and EPDM peroxide-cured rubber (Figure 1). The addition of IL-6 did not show any additional performance improvement. RB7004 also contributed to a substantial improvement in rubber coverage. Percent coverage is indicated above the bars. For adhesive activated (AA) PET, the RB7004/SB blend by itself did not improve RFL adhesion. The addition of IL-6 to the formulation did show a slight improvement in adhesion and rubber coverage (Figure 2). Comparisons in adhesion performance are illustrated in Figures 1 and 2.

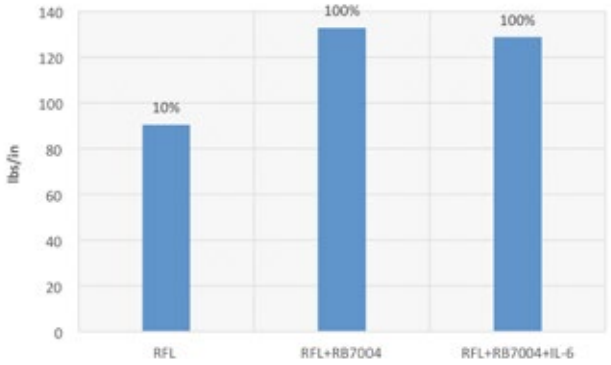

Figure 1: Adhesion performance and percent rubber coverage of RB7004 as additive to RFL for NAA PET

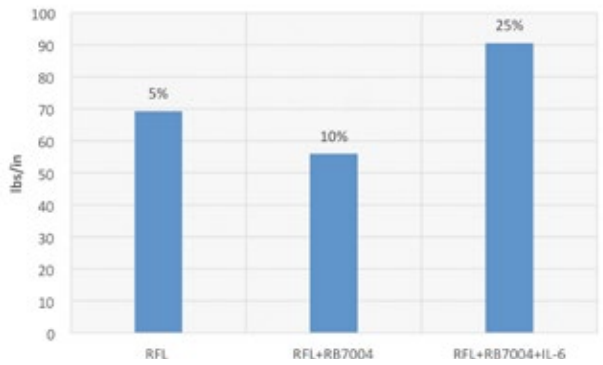

Figure 2: Adhesion performance and percent rubber coverage of RB7004 as additive to RFL for AA PET

Summary

Ricobond 7004 is an aqueous dispersion that promotes adhesion of textile to rubber. When added to an RFL dip, RB7004 improves the adhesion and rubber coverage of PET to EPDM peroxide cured rubber. RB7004 can also be used in RF-free dip formulations. Its compatibility with variety of water-based systems and latexes provides flexibility in formulating. Previous work has shown that RB7004 can offer a simpler and more environmentally friendly dipping process. RB7004 can be used for the treatment of a variety of fibers such as PET, polyamids, carbon fiber and aramids as well as different rubber systems. Ricobond 7004 may also be used as additive in other water-based formulations for adhesives, coatings, paper sizing and composites.

About TOTAL Cray Valley

TOTAL Cray Valley is the premier global supplier of specialty chemical additives, hydrocarbon specialty chemicals, and liquid and powder tackifying resins used as ingredients in adhesives, rubbers, polymers, coatings, and other materials. TOTAL Cray Valley has pioneered the development of these advanced technologies, introducing hundreds of products that enhance the performance of products in energy, printing, packaging, construction, tire manufacture, electronics, and other demanding applications.

For more information, please visit **www.crayvalley.com.**

TOTAL Cray Valley
665 Stockton Drive, Suite 100
Exton, PA 19341, USA
1.877.US1-CRAY

CV1317.8.18