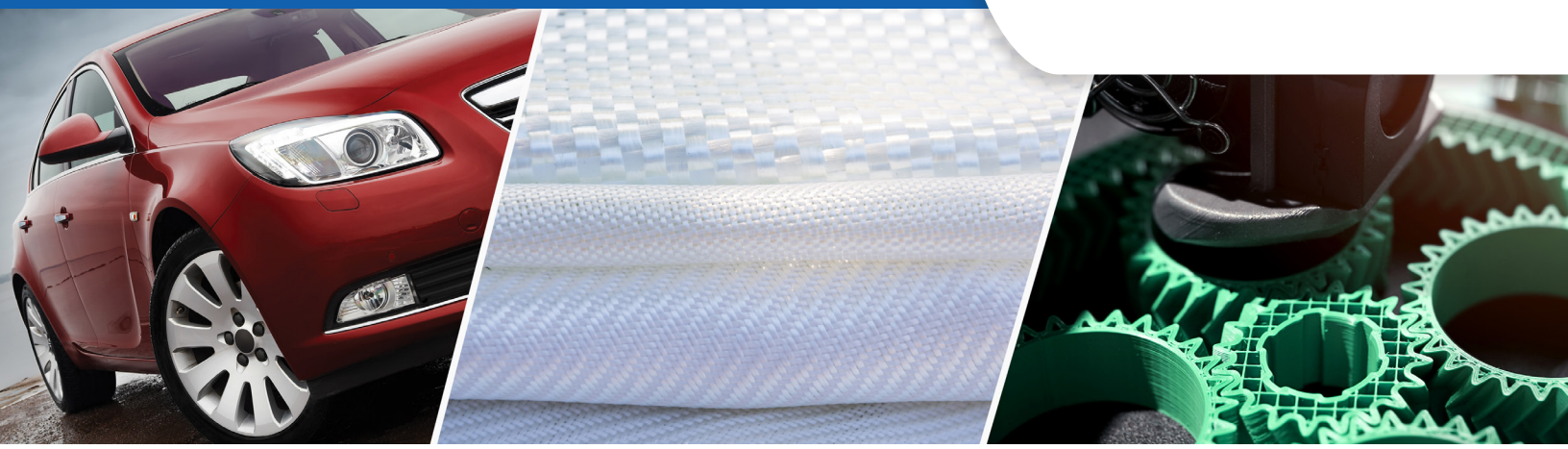
TECHNICAL UPDATE

CRAY VALLEY



BENEFITS

- Improved adhesion between rubber and reinforcing materials
- Compatible with styrene butadiene vinyl pyridine latex
- Water based
- Low viscosity
- Small particle size
- Good wetting
- Improved water resistance
- Long shelf life
- Formulated dips are shelf stable

TARGET MARKETS/ APPLICATIONS

- Textile treatment

ADDITIONAL INFO

- SDS/TDS: Ricobond® 7004

Ricobond® 7004 for Textile Treatment: Adhesion to Sulfur-Cured Rubber

Introduction

Cray Valley has developed Ricobond® 7004 (RB7004), an aqueous dispersion of maleic anhydride functionalized resin. Table 1 lists the chemical and physical properties of Ricobond 7004. When mixed with other waterbased emulsions, Ricobond 7004 can increase rubber adhesion to textile and metal substrates and improve chemical resistance. The hydrophobic and hydrophilic components of Ricobond 7004 allow for interaction between polar and non-polar substrates. The dispersion shows good compatibility when formulated with other latexes such as styrene butadiene (SB) and styrene butadiene vinyl pyridine (VP) emulsions. Formulating with standard latexes can improve adhesion, water resistance, and acid/base resistance. Ricobond 7004 has previously demonstrated good adhesion performance in peroxide-cured EPDM rubber when formulated with SB latexes such as GenFlo® 8045 and GenFlo 3003.

TotalEnergies

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

Ricobond 7004 was formulated with a styrene butadiene vinyl pyridine (VP, GenTac® 106) emulsion. Twenty per cent of Ricobond 7004 was added to VP latex. Good compatibility was observed, and the mixture was homogeneous, grit-free and stable. The blend was used to treat non-adhesive-activated polyester and polyester/nylon woven fabrics. A modified T-peel method was used to test adhesion of the fabrics to NR/SBR sulfur-cured rubber. Table 2 shows the rubber compound formula and additives.

Table 2: Rubber Model Compound

Additive/Compound	
First Stage	
SBR-1502 (styrene butadiene rubber)	50.0
SVR-CV60 (natural rubber)	50.0
CB N330 (carbon black)	50.0
Sundex® 790 (oil)	10.0
Zinc oxide	3.0
Stearic acid	2.0
Second Stage	
TBBS (N-tert-butyl-2-benzothiazyl sulfonamide)	0.7
6PPD (solid) (N-(1,3-Dimethylbutyl)-N'-phenyl-p-phenylenediamine)	1.0
TMQ (solid) (1,2 dihydro 2,2,4 trimethylquinoline)	0.5
Sulfur	2.0

Procedure and Testing

Sample Preparation

A two-step dipping process was used to treat the polyester fabric. The fabric was first treated with a standard polyester primer. Table 3 shows the primer formulation.

Table 3: Primer formulation

Water	91.45
Grilbond® IL-6 (60%) (aqueous blocked isocyanate)	6.0
Aerosol OT 75 (75%) (sodium dioctyl sulfosuccinate surfactant)	0.19
Grilbond G1701 (aqueous epoxy resin)	1.36
Total	100.0
Primer solids	5.1%

The second dip was a 20:80 blend of Ricobond 7004 and VP latex. The final blend was then diluted to 25% solids. The polyester/nylon fabric was treated using just one dip process. For this treatment the VP/Ricobond 7004 blend was used. Below is an outline of the treatment processes.

Non-adhesive-activated polyester fabric

- Fabric pretreated using the primer
- Dried at room temperature
- Dried in an oven at 220°C for 2 minutes
- Treated with the VP/Ricobond 7004 blend
- Dried at room temperature
- Dried in an oven at 215°C for 3 minutes

Polyester/nylon fabric

- Fabric dipped in the VP/Ricobond 7004 blend
- Dried at room temperature
- Dried in an oven at 215°C for 3 minutes

A blend containing VP latex, Ricobond 7004 and an aqueous isocyanate (ISO) was also evaluated. Plaques of rubber-fabric-rubber were made and cured at 160°C for 25 minutes in a heated press. These plaques were then cut into four 1-inch by 5-inch strips.

Testing

A modified ASTM D1876 T-peel method was adapted to test the adhesion of the treated fabric to cured EPDM rubber as illustrated in Figure 1. A Thwing-Albert EJA Vantage 10 tensile tester was used to perform the testing. T-peel speed and distance were constant for all samples. All strips were tested at room temperature (27°C) and at 50% relative humidity.

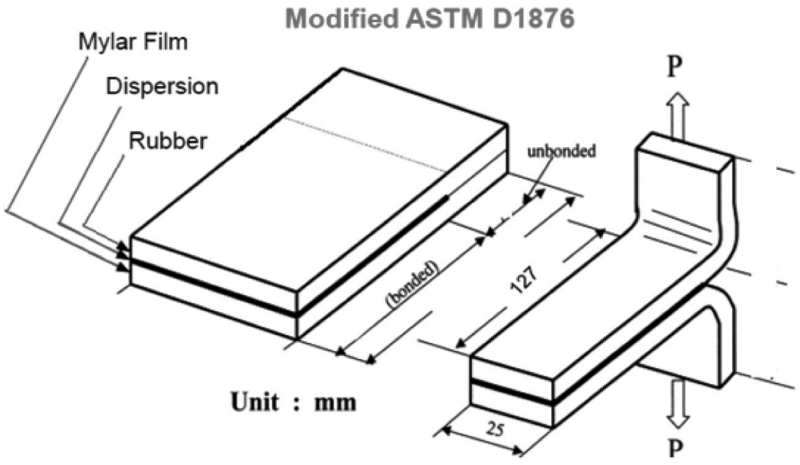


Figure 1: Modified ASTM D1876 test

Results

The addition of Ricobond 7004 to VP latex shows improvement in adhesion between treated fabric and rubber. For polyester/nylon fabric, the addition of both ISO and Ricobond 7004 to the VP latex resulted in the best adhesion values for this fabric as shown in Figure 2.

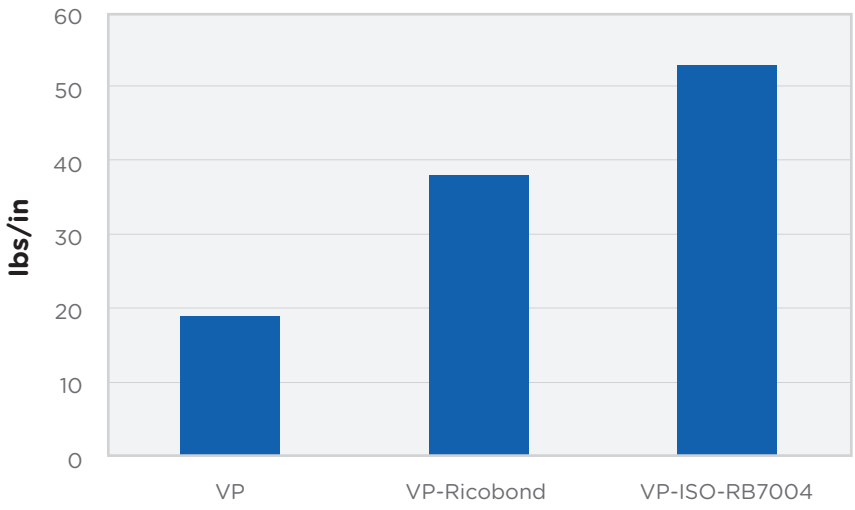


Figure 2: Adhesion of treated polyester/nylon fabric to NR/SBR rubber

Contrary to the results obtained in the polyester/nylon fabric, ISO seems to have no effect on adhesion when treating non-adhesive-activated polyester fabric (Figure 3). High adhesion values are observed when adding Ricobond 7004 to VP latex.

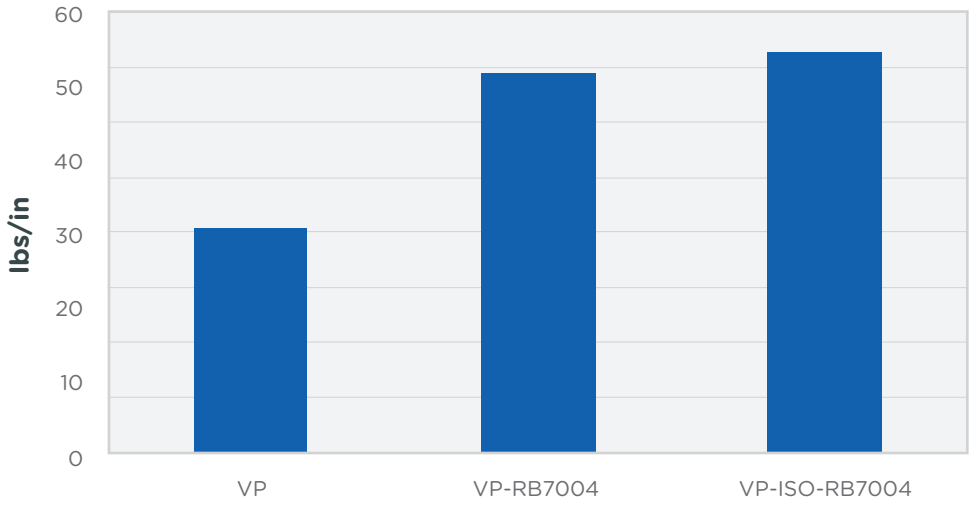


Figure 3: Effect of aqueous isocyanate on adhesion of non-adhesive-activated polyester fabric to NR/SBR rubber

In Figure 4, RFL dip was evaluated as a benchmark. The adhesion values were comparable to or slightly lower than the Ricobond 7004. The overall adhesion values were lower than those shown in Figures 2 and 3, but this can be attributed to lower pick-up of the dip onto the fabric.

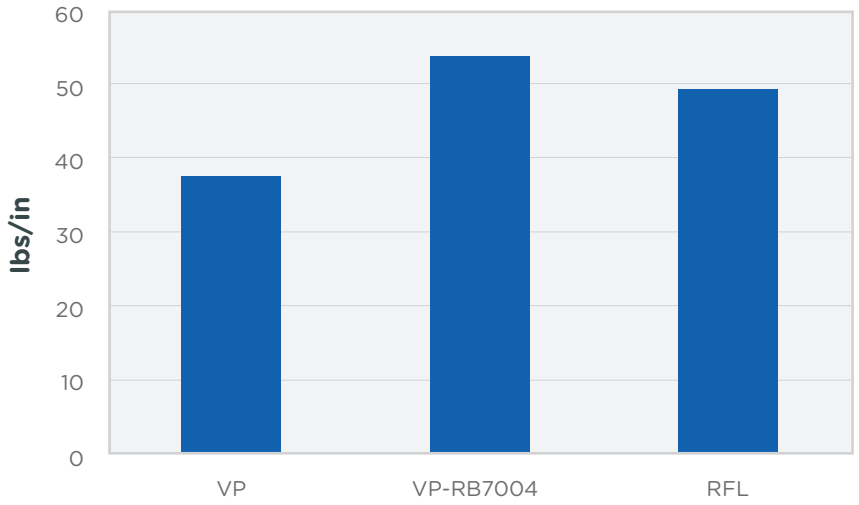


Figure 4: Adhesion of treated non-adhesive-activated polyester fabric to NR/SBR rubber

Summary

Ricobond 7004 can be blended with SB and VP latexes as adhesion promoters for textile treatment formulations. In sulfur-cured systems, the addition of Ricobond 7004 to VP latex results in improved adhesion.

Other Suggested Applications

Ricobond 7004 may also be used in UV-curable waterborne coatings and as an additive in paper and glass fiber sizing to improve adhesion in composites. It can also be used to modify surface reinforcing fillers and fibers to improve dispersion in elastomers and reinforced resin systems used in composites and 3D printing.

About Cray Valley

As part of the TotalEnergies family, 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. 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 or to contact us, please visit **www.crayvalley.com**.

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