



BENEFITS

- Process optimization
- Design flexibility

TARGET MARKETS/ APPLICATIONS

- Coatings
- Encapsulations for electronics
- Specialty adhesives and sealants

ADDITIONAL INFO

- Poly bd[®] Resins in the Coating Industry
- Krasol[®] F3000 Novel Bio-Based Diol for Polyurethanes
- TDS Poly bd[®] R45HTLO
- TDS Poly bd[®] R20LM
- TDS Krasol[®] F3000

Poly bd[®] R20LM and Krasol[®] F3000 Viscosity Modifiers for Polybutadiene- Based Polyurethanes (PU)

Introduction

Polyurethanes based on hydroxyl terminated polybutadiene (HTPB) polyols are known for excellent hydrophobicity, hydrolytic and chemical resistance, electrical insulation properties, and low-temperature flexibility. However, polybutadiene based urethanes could be difficult to handle due to their high viscosity. Blending HTPB polyols with Poly bd[®] R20LM and Krasol[®] F3000 allows for a reduction of the viscosity, introducing more freedom in PU processing and formulation.

Product description

Poly bd R45HTLO and Poly bd R20LM resins are liquid hydroxyl terminated polybutadienes. Krasol F3000 is a primary hydroxyl terminated diol based on bio-based feedstock. Structures are illustrated in Figure 1 and the general properties are reported in Table 1.

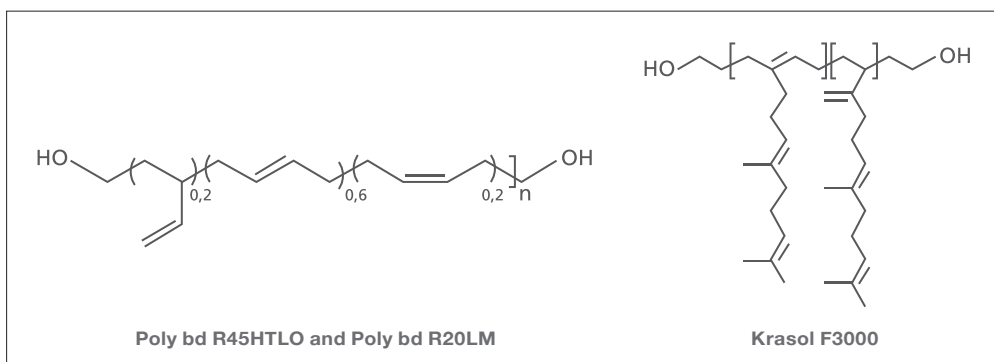


Figure 1: Structure of Poly bd R45HTLO, Poly bd R20LM and Krasol F3000.

Table 1: Typical properties of Poly bd R45 HTLO, Poly bd R20LM and Krasol F3000.

Properties	Poly bd R45HTLO	Poly bd R20LM	Krasol F3000
Viscosity (cPs) @ 25 °C	6800	3000	1700
OH type	Primary	Primary	Primary
1,2 Vinyl (%)	20	20	-
3,4 Vinyl (%)	-	-	40
Functionality	2.3 – 2.5	2.3 – 2.5	1.9 – 2.0
Mn (g/mole)	2800	1200	3000
Glass Transition Temp (°C)	-75	-70	-65

The low molecular weight of Poly bd R20LM and the unique macromolecular structure of the Krasol F3000 provide lower viscosity molecules than the Poly bd R45HTLO, as illustrated in Figure 2. The variation of the viscosity of mixtures at various ratios of Poly bd R45HTLO/Poly bd R20LM and Poly bd R45HTLO/Krasol F3000 is shown in Figure 3.

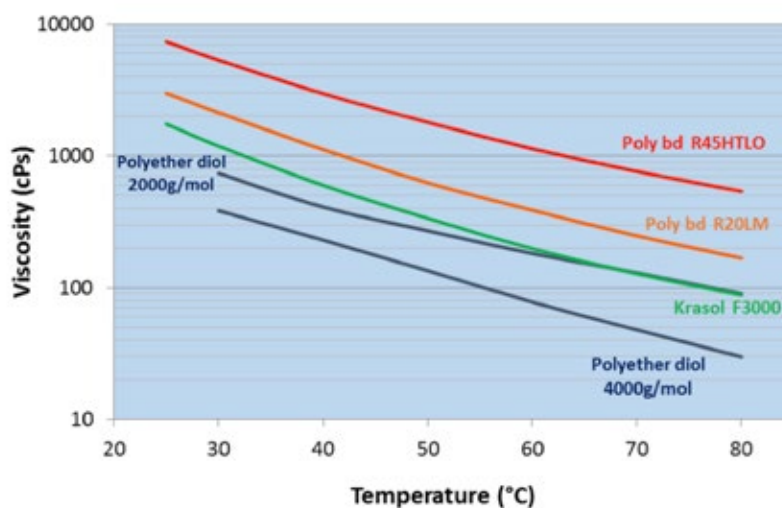


Figure 2: Viscosity vs temperature of Poly bd R45HTLO, R20LM, Krasol F3000 and some commercially available polyether diols.

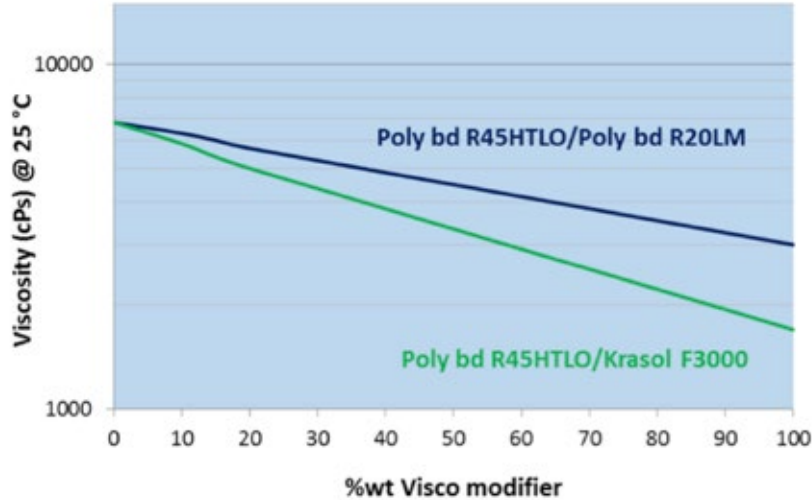


Figure 3: Viscosity vs weight percent of Poly bd R20LM or Krasol F3000 blended with Poly bd R45HTLO.

Performance of the Poly bd R20LM and Krasol F3000 in PU Formulations

Several PU formulations have been prepared via a one-step process using a ratio of isocyanate/hydroxyl (NCO/OH) = 1. Dibutyltin dilaurate (DBTDL) was used as a catalyst and the mixtures were cured at 80 °C. Formulations are summarized in Table 2 and the mechanical properties are shown in Figure 4.

Table 2: Polyurethane Formulations

Properties	Ref	1	2	3	4
Poly bd R45HTLO (g) <i>From Total Cray Valley</i>	100	90	85	90	
Poly bd R20 LM (g) <i>From Total Cray Valley</i>			15		100
Krasol F3000 (g) <i>From Total Cray Valley</i>		10		10	
Viscosity of the blend (cPs) @ 25 °C	6,800	6,000	6,030	6,000	1,400
Viscosity of the blend (cPs) @ 40 °C	3,000	2,500	2,500	2,500	1,120
2-ethyl-1,3-hexanediol (g) <i>From KH Neochem Co.</i>	20.9	20.8	20.3	16.7	17.3
Mix of 2,4' and 4,4'-methylene diphenyl diisocyanate (g) <i>From BASF</i>	45.8	45.9	46.4	38.7	49.3
Hard content (%)	40	40	40	35	40

Catalyzed with 3 drops of 10% diluted DBTDL (from Alfa Aesar) in Krasol F3000.

Introducing 10 weight percent of Krasol F3000 (formulation 1) or 15 weight percent of Poly bd R20LM (formulation 2) in Poly bd R45HTLO allows a 20% reduction of the viscosity of the Poly bd R45HTLO, while mechanical properties are largely maintained.

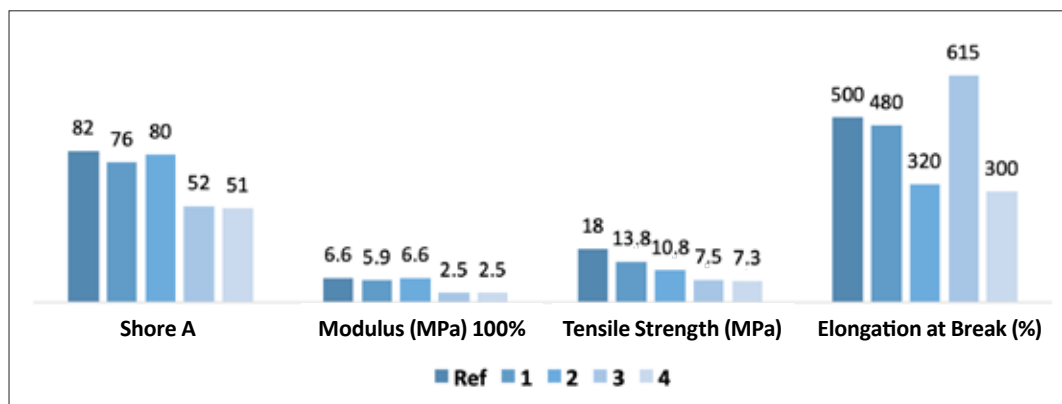


Figure 4: Cured polyurethane evaluation results.

When Krasol F3000 is used at 10 weight percent with Poly bd R45HTLO (formulation 3), the blend outperforms a PU produced with 100 weight percent of Poly bd R20LM (formulation 4) in terms of elongation at break, with similar mechanical properties.

Summary

Polybutadiene resins such as Poly bd R45HTLO have been used in various PU applications to provide resistance to aqueous, acidic and basic chemicals, low temperature flexibility and high adhesion to metals and glass. However, the high viscosity of such materials could be a practical limitation. Therefore, introducing Poly bd R20LM or Krasol F3000 provides the formulator with additional tools to design new PU materials at lower process viscosities.

Regulatory Compliance

Poly bd R20LM and Poly bd R45HTLO are regulated by the United States Department of Commerce and may not be exported without license from that organization.

No license is required by the US Department of Commerce for Krasol F3000 export. Krasol F3000 is listed on the US Toxic Substances Control Act (TSCA) Chemical Substance Inventory. Krasol F3000 is a polymer and thus is exempted from registration within REACH.

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 manufacturing, 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

*The listed properties are illustrative only, and not product specifications. TOTAL Cray Valley disclaims any liability in connection with the use of the information, and does not warrant against infringement by reason of the use of its products in combination with other materials or in any process.

CV1326.2.19