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The effect of ISB-TPU as mechanical properties and adhesion due to the introduction of multi-functional groups

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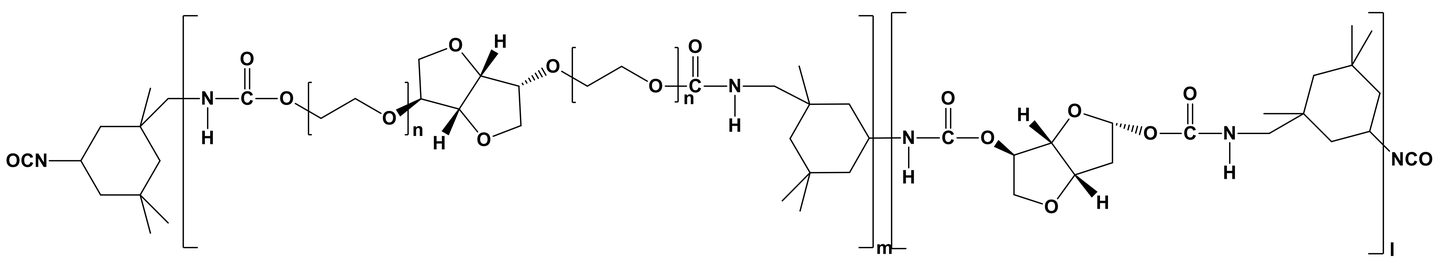
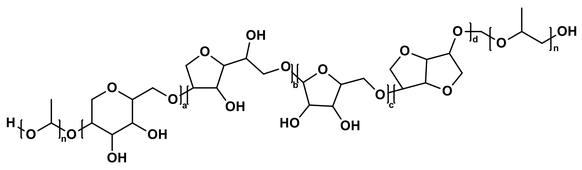
Abstract

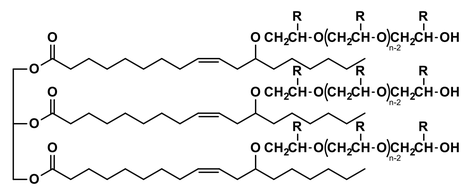
Isosorbide-based thermoplastic polyurethanes (ISB-TPUs) were successfully synthesized using condensation polymerization based on ISB-polyol and isocyanates such as IPDI/H12MDI as soft segments, and 1,3-PD chain extenders as hard segments. Multi-functional polyol was added to the synthesized ISB-TPU to increase molecular weight and significantly affected mechanical properties. The synthesis of ISB-TPU was confirmed by Fourier transform infrared spectroscopy (FT-IR) and gel permeation chromatography (GPC). Both film tensile strength and adhesive shear strength through blending with epoxy were evaluated by universal testing machine (UTM). ISB-TPU can be applied to a variety of adhesives depending on the required properties, as the increase in molecular weight is controlled by adding multi-functional polyol groups, and the higher the molecular weight, the greater the increase in properties such as toughness.

Experimental

Scheme

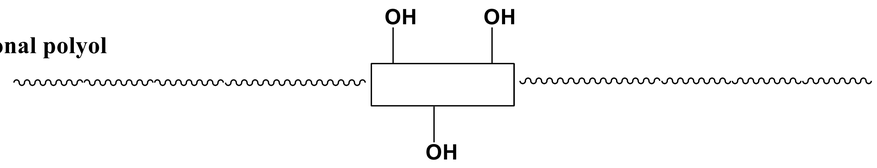




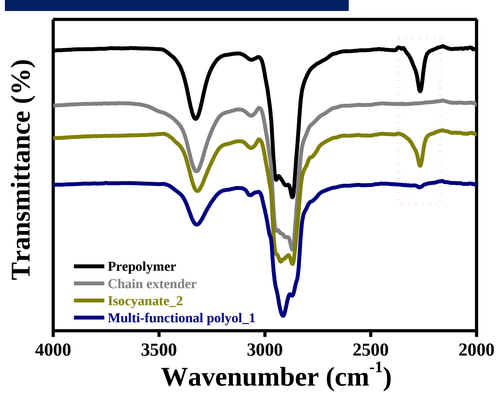


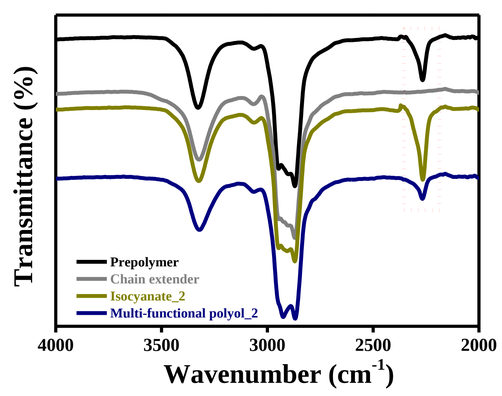
: Bio-PU(10K)

: Multi-functional polyol



FT-IR & GPC

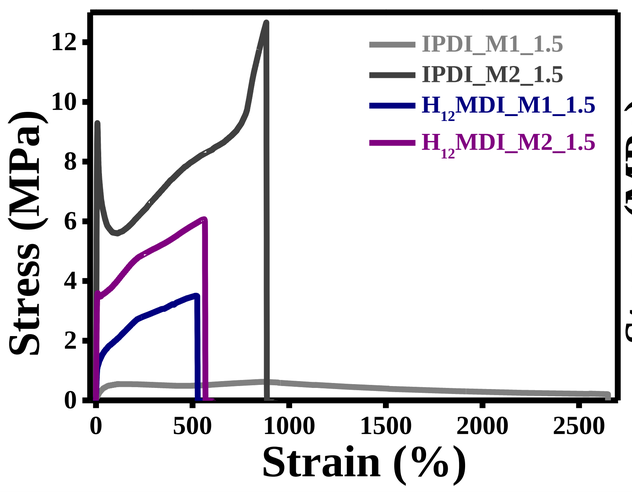


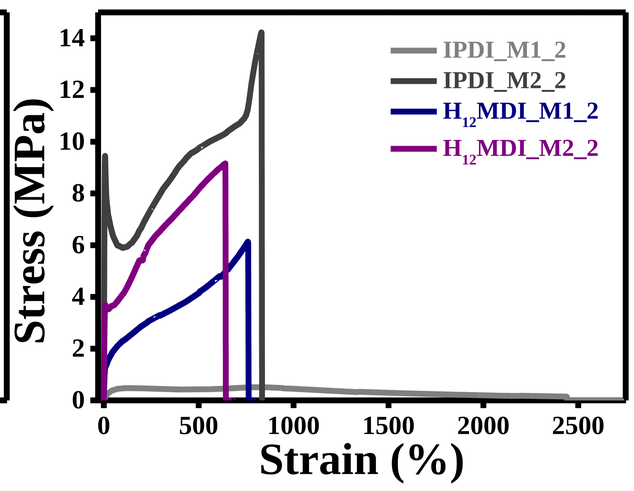


Prepolymer	Chain extender	Multi-functional polyol	Target MW	Mn	PDI
ISB-polyol + IPDI	1,3-PD	M1	Prepolymer 10K	10355	1.70
			16K(1:1.5)	15955	1.70
			21K(1:2)	21209	1.72
ISB-polyol + H_{12}MDI			Prepolymer 10K	11796	1.71
			16K(1:1.5)	16356	1.64
			21K(1:2)	23576	1.67
ISB-polyol + IPDI		M2	Prepolymer 10K	11536	1.78
			16K(1:1.5)	15707	1.85
			21K(1:2)	21843	1.49
ISB-polyol + H_{12}MDI			Prepolymer 10K	9150	2.10
			16K(1:1.5)	17463	1.79
			21K(1:2)	23065	1.91

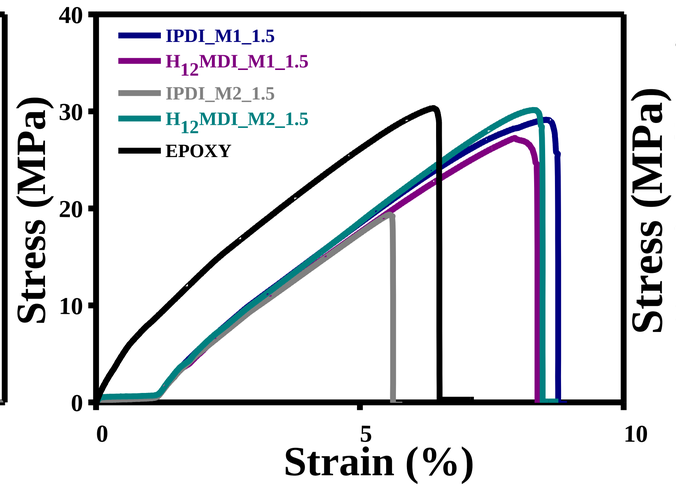
Results

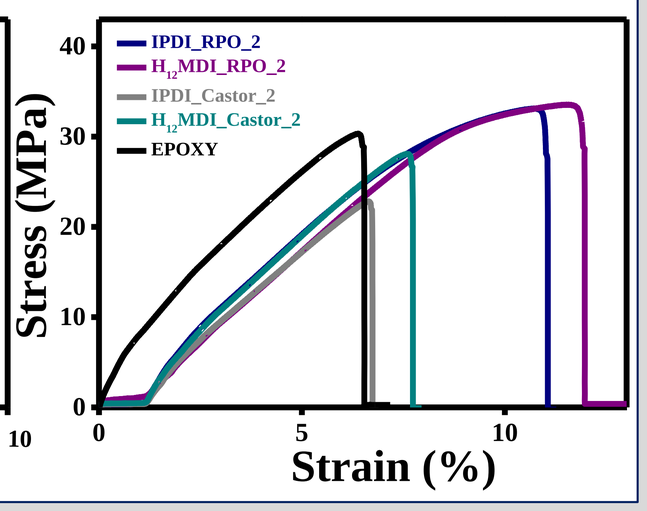
Film-UTM





Adhesive -UTM





Conclusion

- A multi-functional groups series of RPO300/Castor oil-based ISB-TPU were successfully controlled
- Increase of mechanical properties of film using H12MDI and multi-functional polyol_2
- In Bio-PU with multi-functional polyol added, as molecular weight increases, adhesion is affected

Acknowledgement

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