

Improving the Adhesion Properties and increasing bio-content of Structural Epoxy Adhesives : Using Bio-based polyurethane and bio-based core-shell rubber

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Abstract

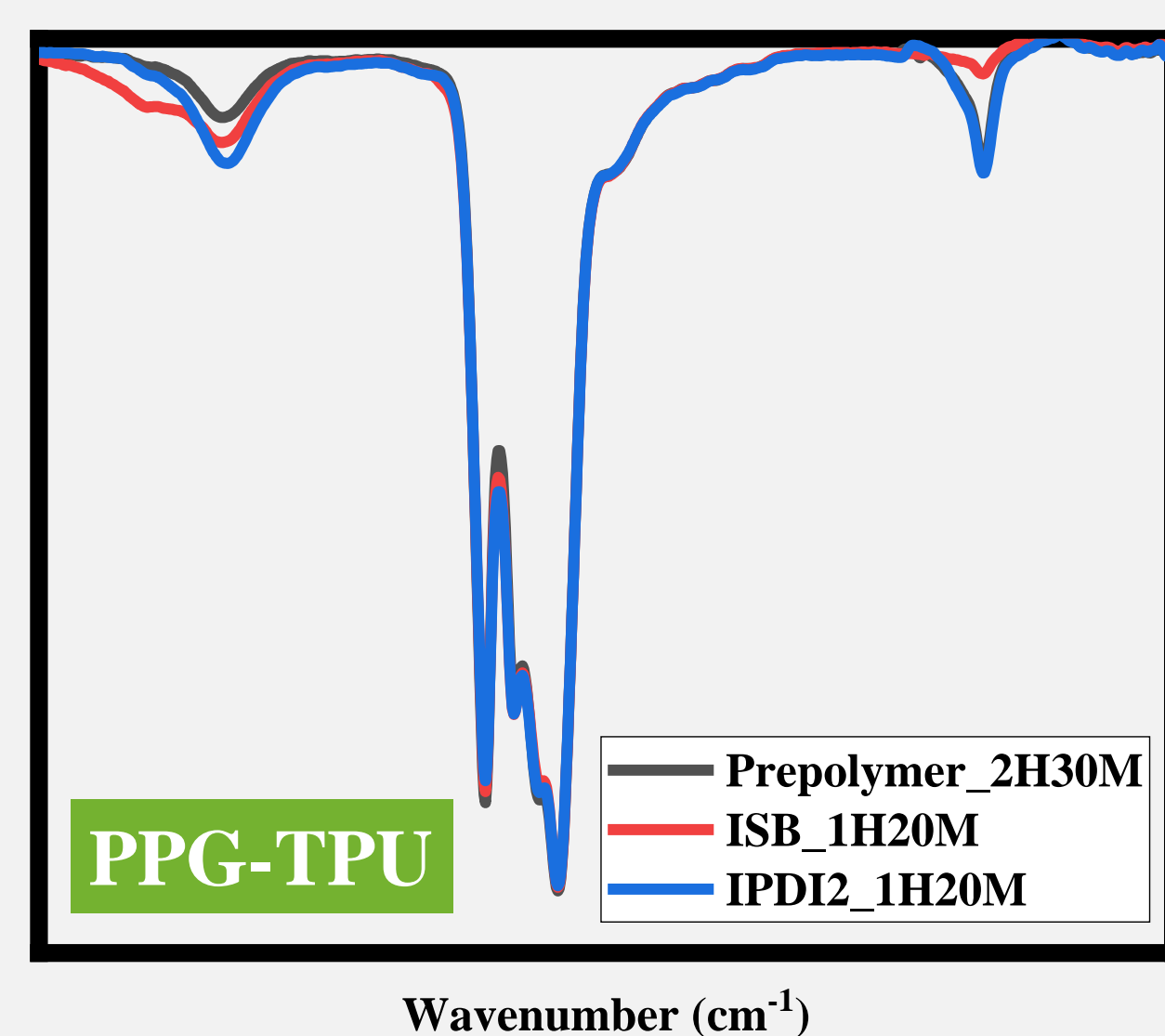
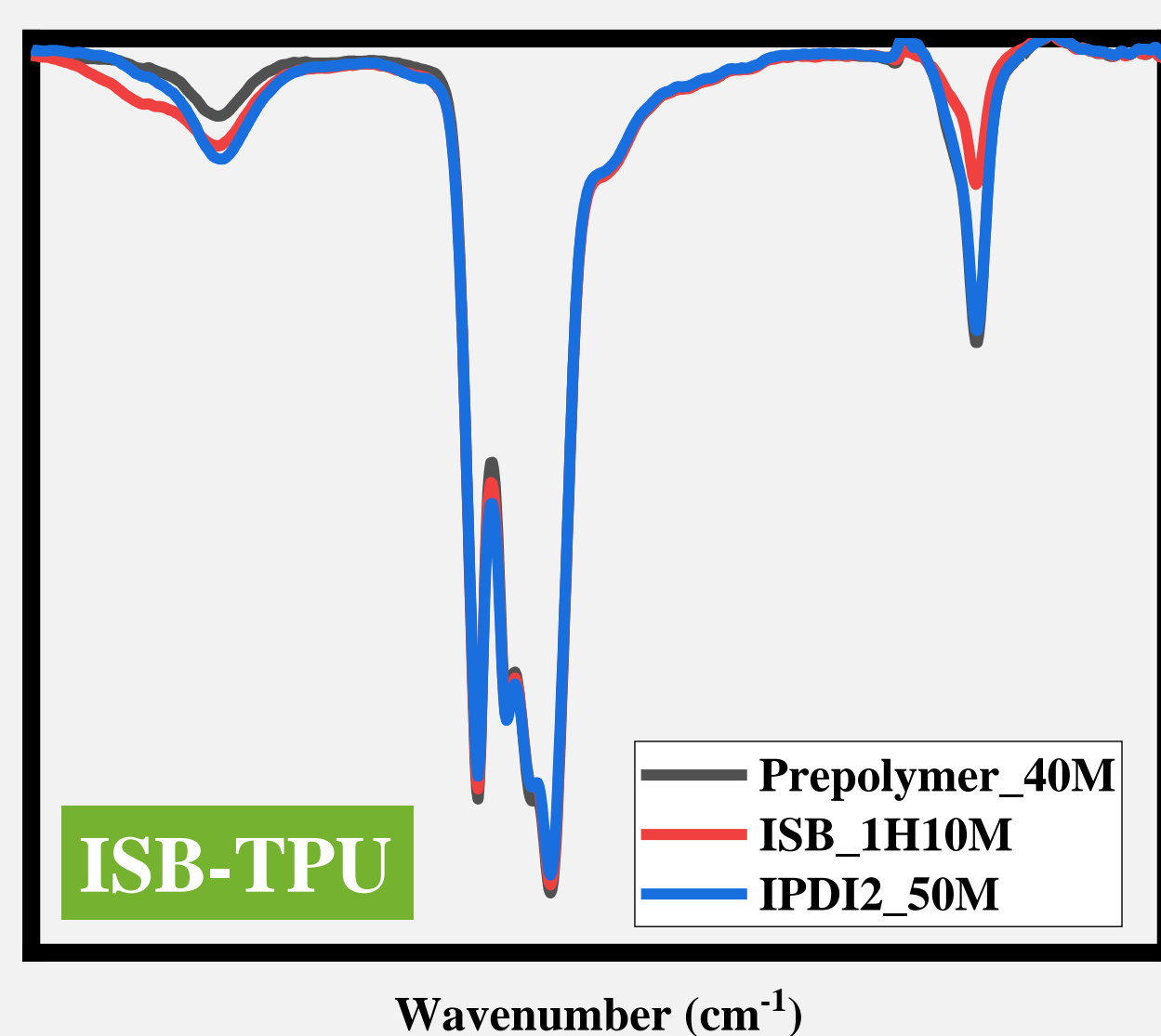
To improve the properties of epoxy adhesive, a series of thermoplastic polyurethanes (TPUs) with similar hard/soft segment ratio were successfully synthesized by step-polymerization using two types of polyols, isosorbide-based polyol modified with ethylene oxide and poly(propylene glycol) (PPG). And TPUs were synthesized by two types of polyols as the soft segment, and Isosorbide (ISB) and IPDI as hard segment. The molecular weights are 10,000 (10K) / 20,000 (20K), respectively. The structure of TPUs series were analyzed by fourier transform infrared spectroscopy (FT-IR) and gel permeation chromatography (GPC). The thermal properties indicated by the structure of the polyol were analyzed by thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC). Also, succeeded in synthesizing of bio-based core-shell rubber. Hydroxyl terminated polybutadiene (HTPB) was used for core, and bio-based polyurethane acrylate (PUA) was used for shell. Finally, universal testing machine (UTM) was used to confirm the improvement of adhesive properties.

Objective

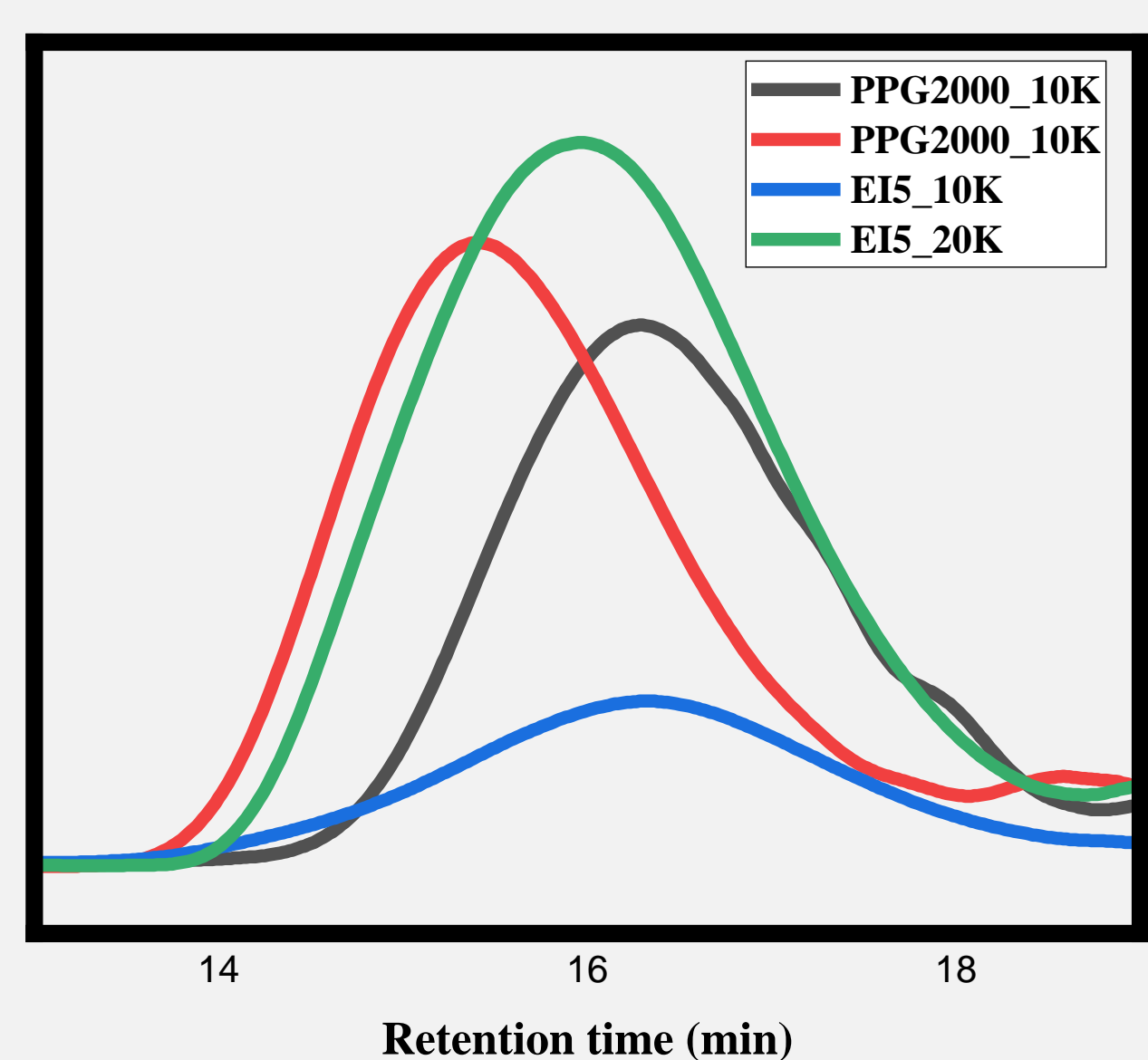
1. To synthesize ISB-TPU series composed of Isosorbide based polyol or PPG as the polyol and IPDI as the isocyanate and ISB as the chain extender
2. Comparison of characteristics according to polyol & Molecular weight
3. To evaluate the adhesive properties of ISB-TPUs
4. Certification of biodegradability of ISB through OECD 301F

Synthesis result

FT-IR

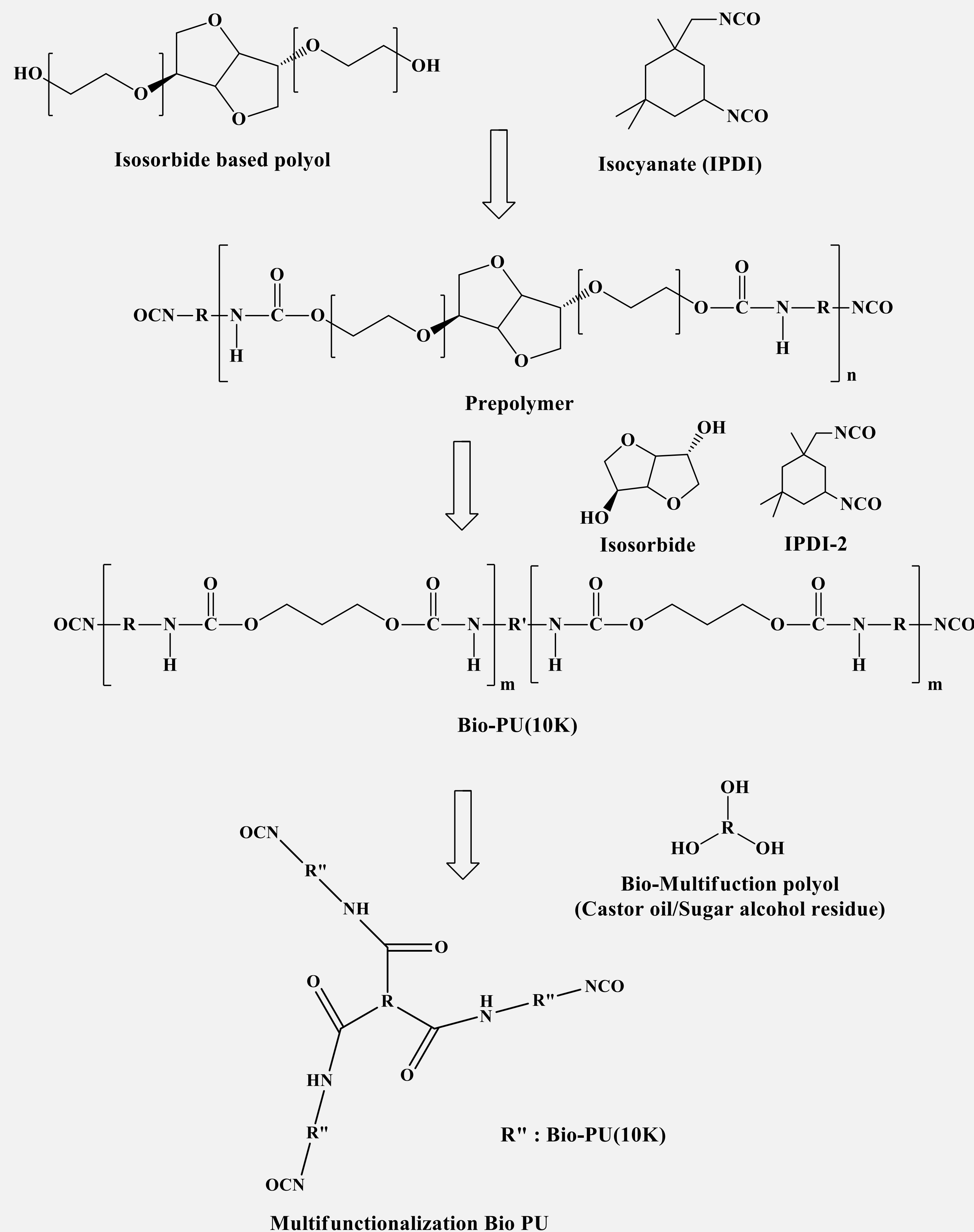


GPC

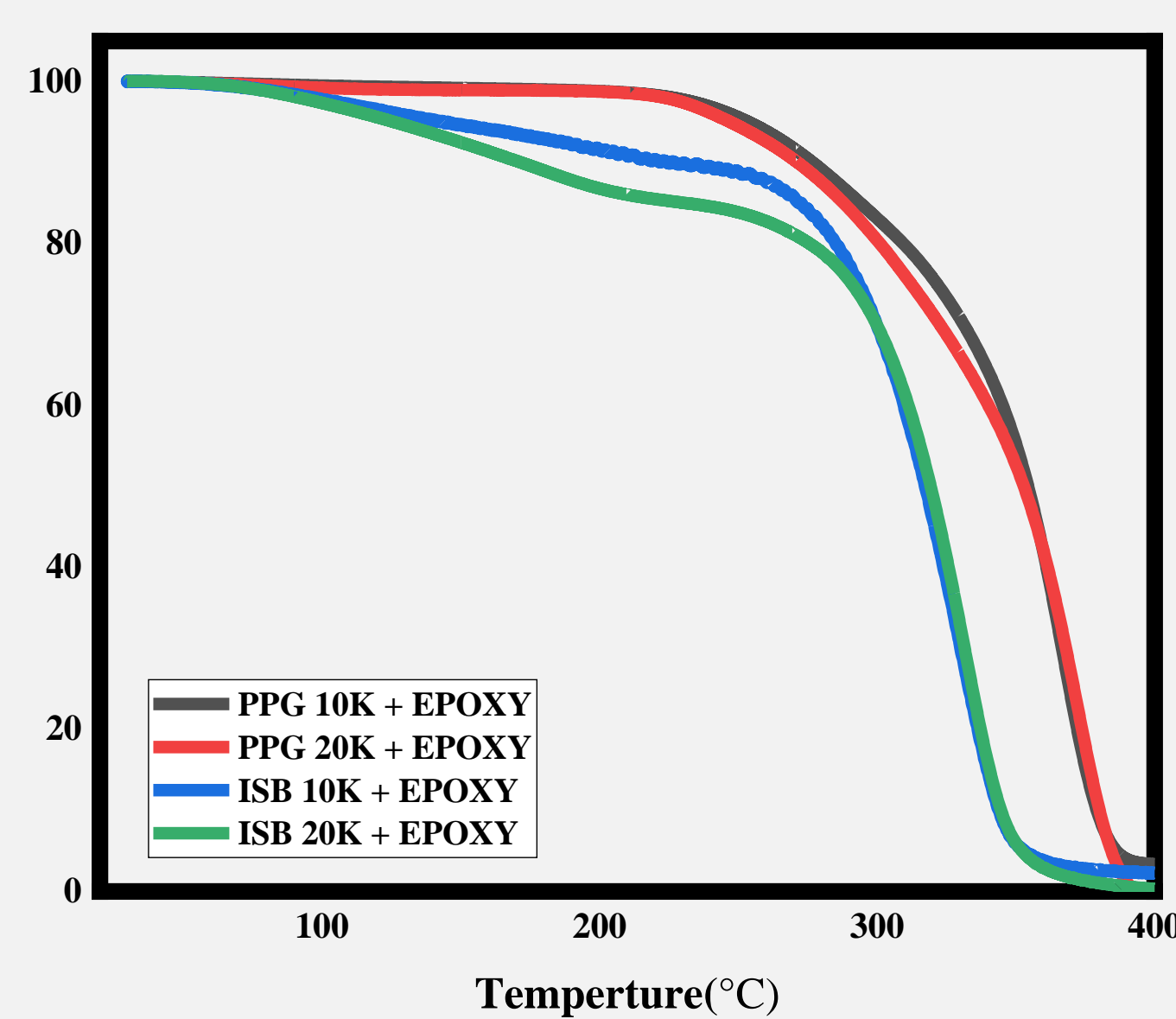


Sample Code	Average Molecular Weight	
	Mn (g/mol)	PDI
PPG2000 PU 10K	11427	1.80
PPG2000 PU 20K	26894	1.62
ISB polyol PU 10K	12554	2.01
ISB polyol PU 20K	18521	1.83

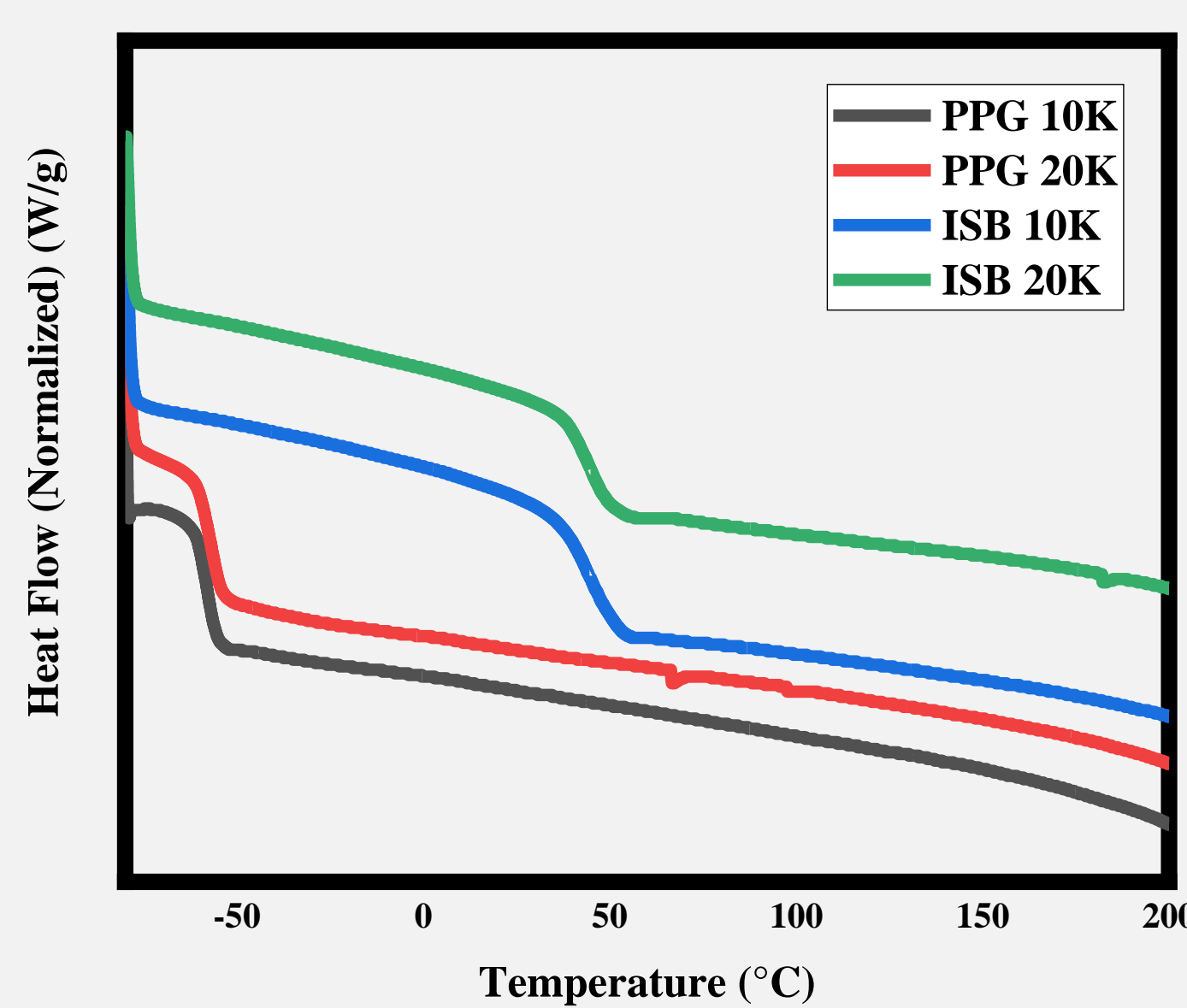
Experimental



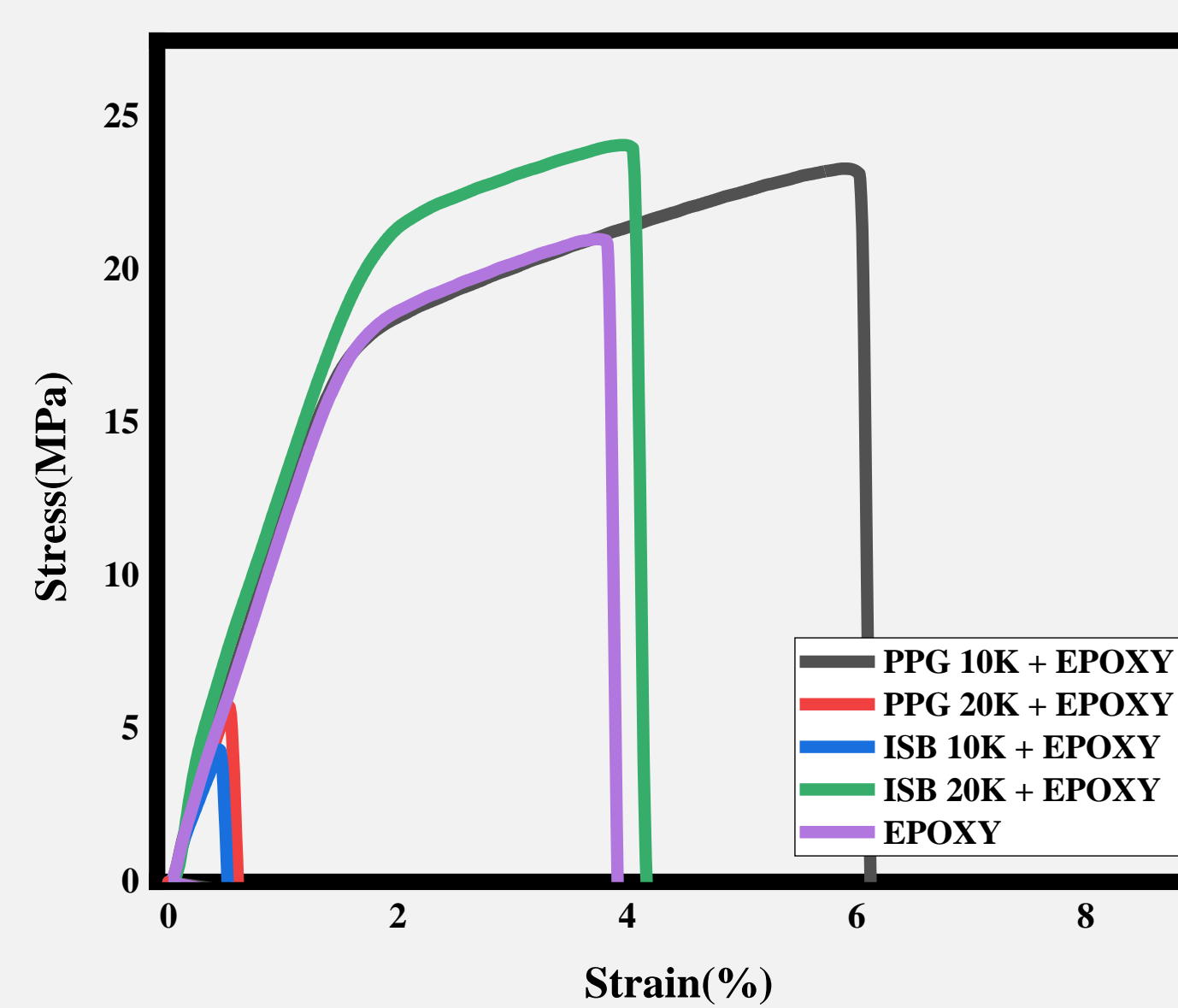
TGA



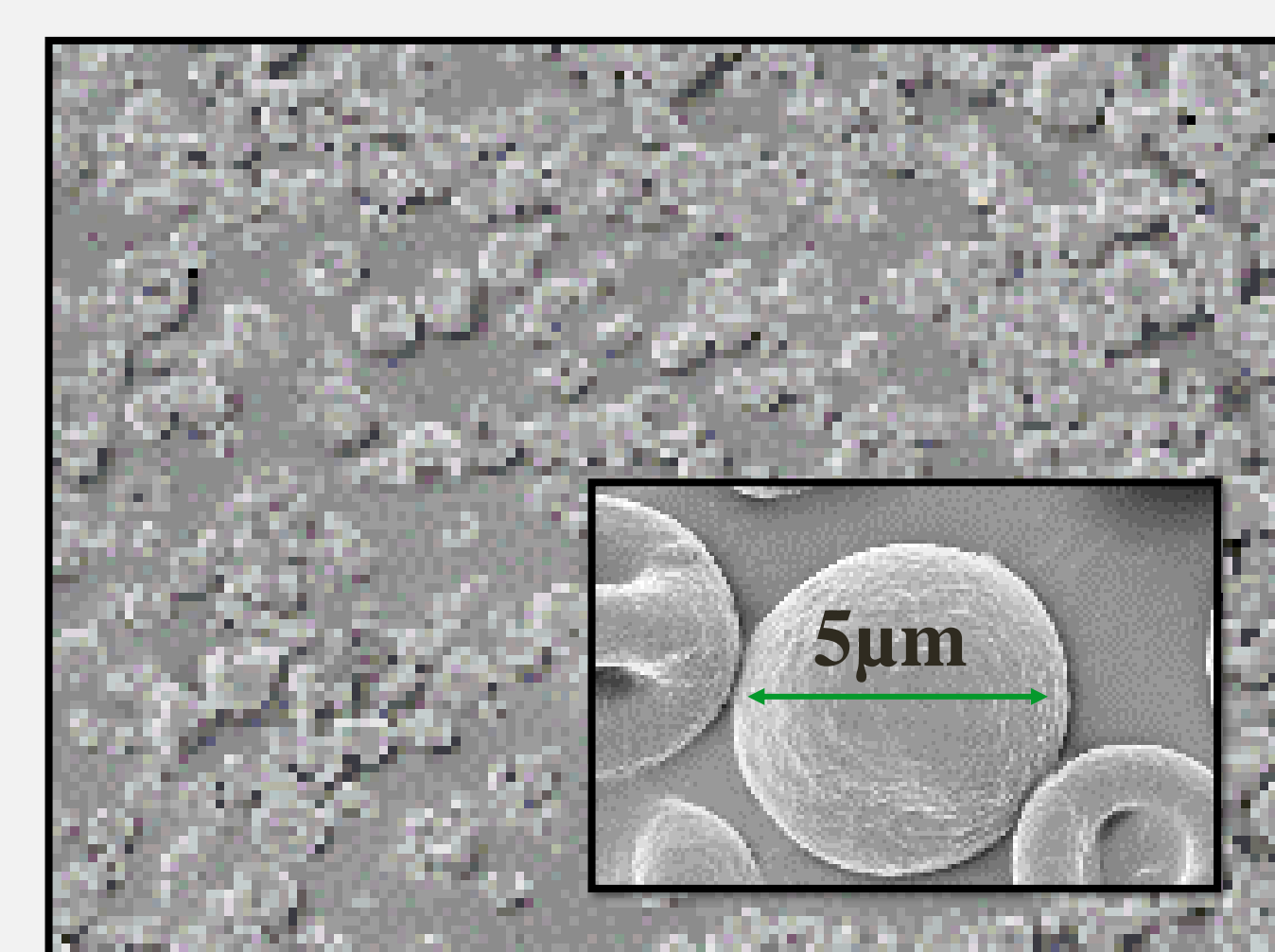
DSC



UTM



Core shell rubber - SEM



Conclusion

- ISB-TPUs & Core shell rubber are successfully synthesized
- ISB-TPUs improved thermal properties, because of ISB is hardly interacting each other
- ISB-TPUs improved mechanical properties, because of ISB-TPU have higher polarity then PPG-TPU
- Bio-CSR is are successfully synthesized in nano size

Acknowledgement

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