

# Effect of Soft/Hard Segments ratios in Poly(tetramethylene glycol)-Polyurethane for Water Barrier Film

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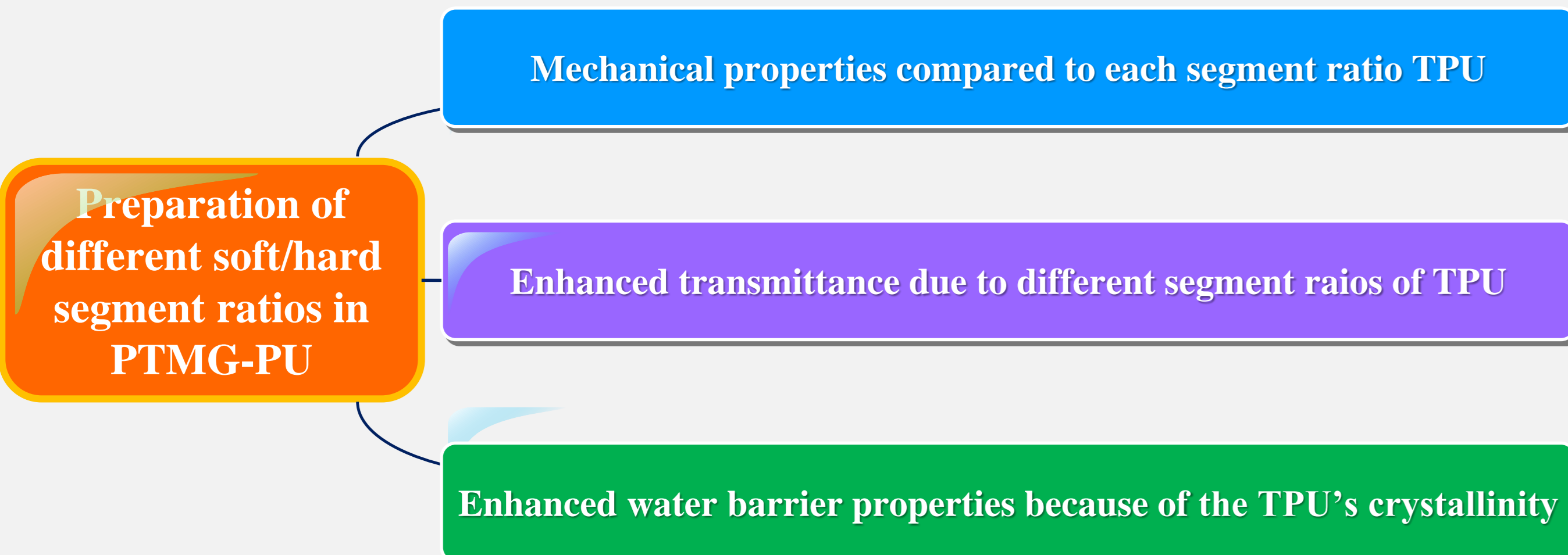
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## Abstract

A series of thermoplastic polyurethanes (TPUs) with the same molecular weight but different soft/hard segment ratios were synthesized by in-situ condensation polymerization using poly (tetramethylene glycol) (PTMG) as the polyol and methylene diphenyl diisocyanate (MDI) as the isocyanate. The weight fractions of the hard segments were varied from 0.0 to 0.4. The structures of the TPU series were analyzed by Fourier transform infrared spectroscopy and gel permeation chromatography. The changes in the thermal and optical properties due to the hard segment crystallinity were also measured by differential scanning calorimetry and UV-Vis spectroscopy. Increasing the hard content promoted phase separation and served as absorption blocks in the TPU. The water vapor permeability of the TPU films with different soft/hard ratios ranged from 223.63 to 116.26 g/m<sup>2</sup>·day.

## Objective

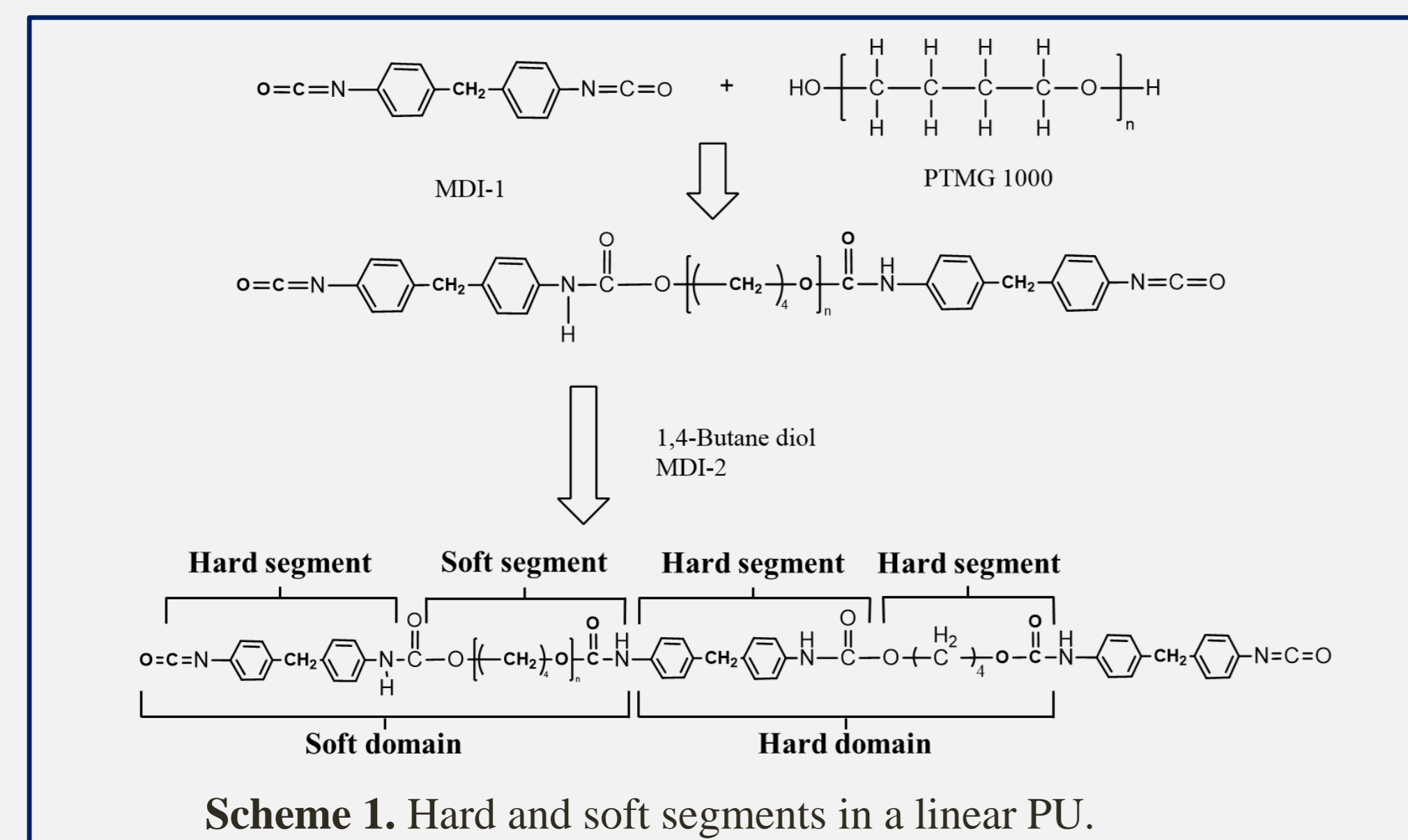
1. Synthesis of thermoplastic polyurethanes with the similar molecular weight but different soft/hard segment ratios
2. Different soft/hard segment ratio used as a key to control the phase separation and absorption blocks of thermoplastic polyurethanes
3. Effects of soft/hard ratios on the water-vapor barrier property, which leads to the reinforcing encapsulation performance of thermoplastic polyurethane



## Experimental

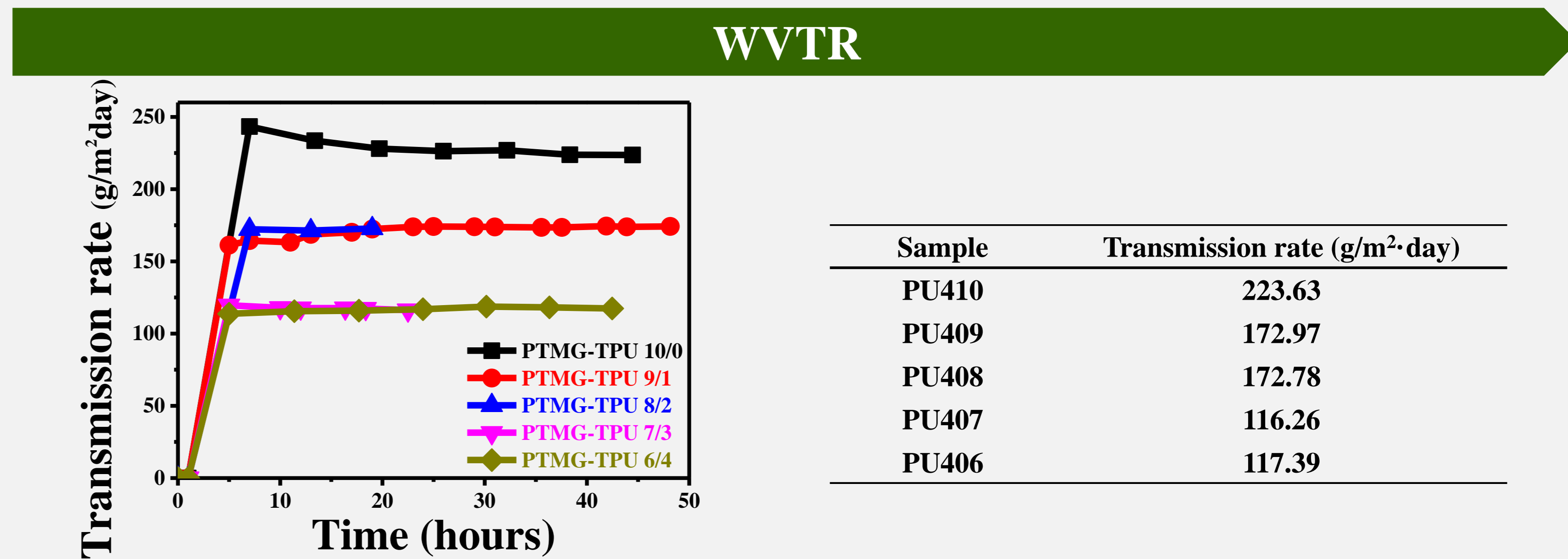
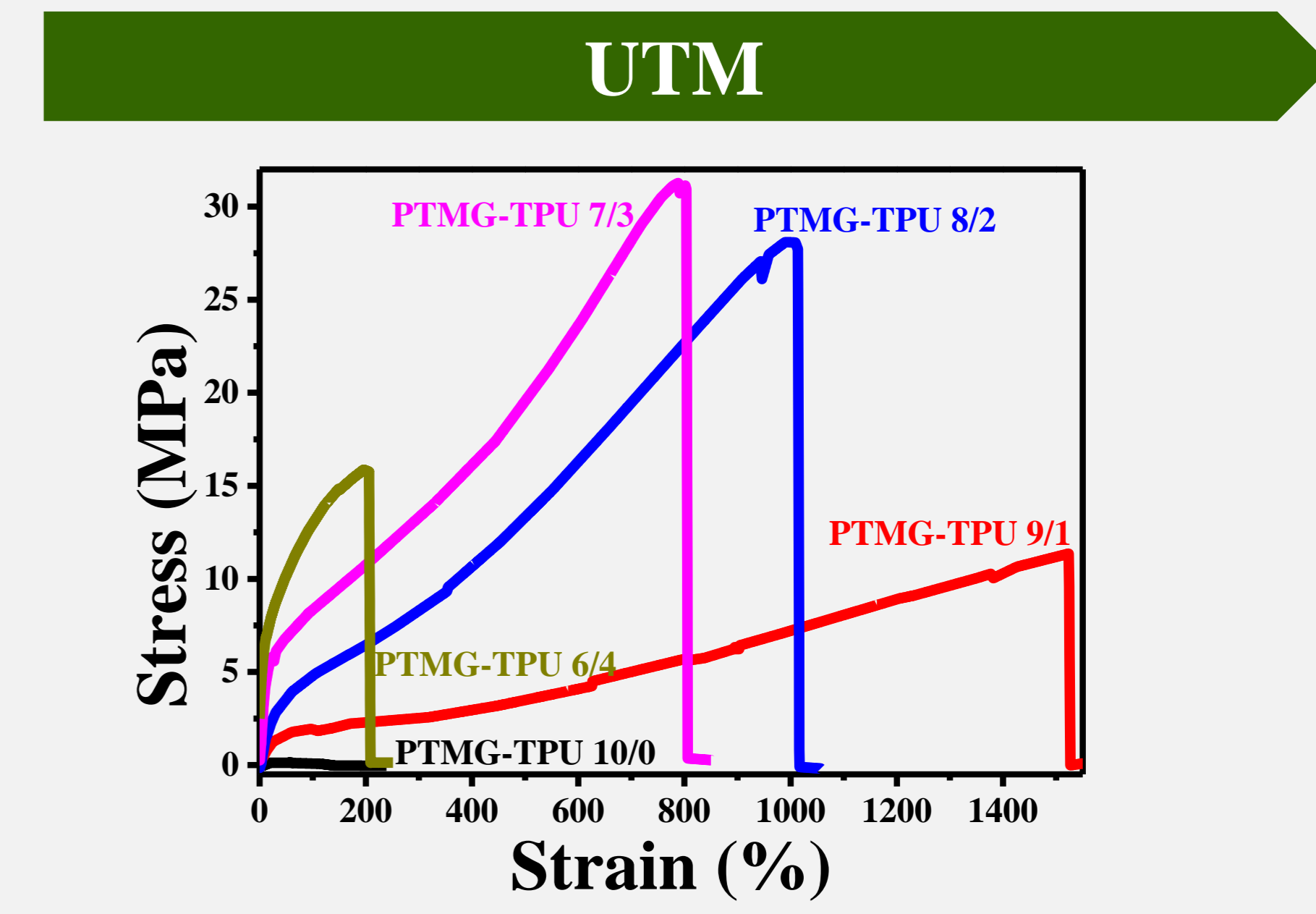
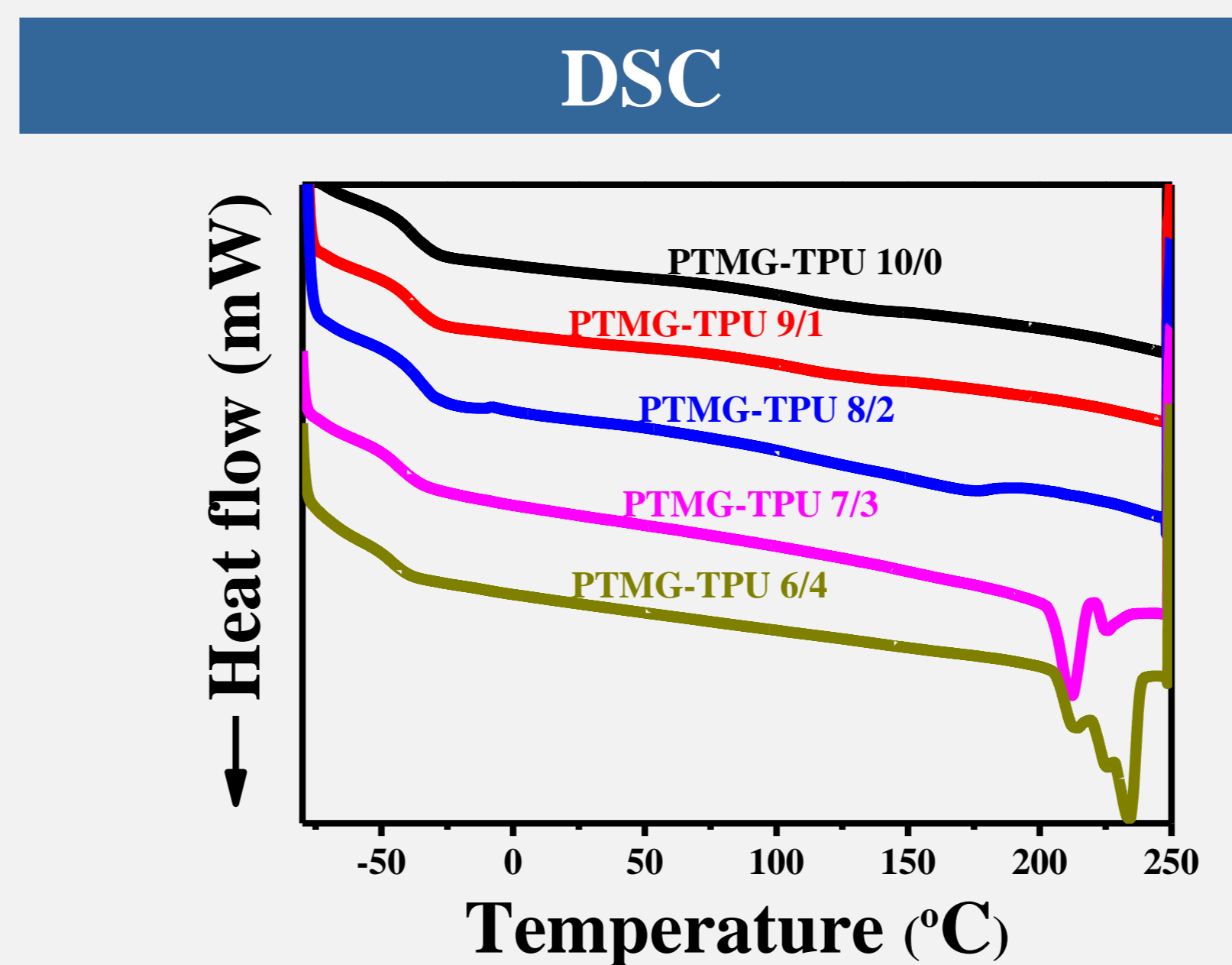
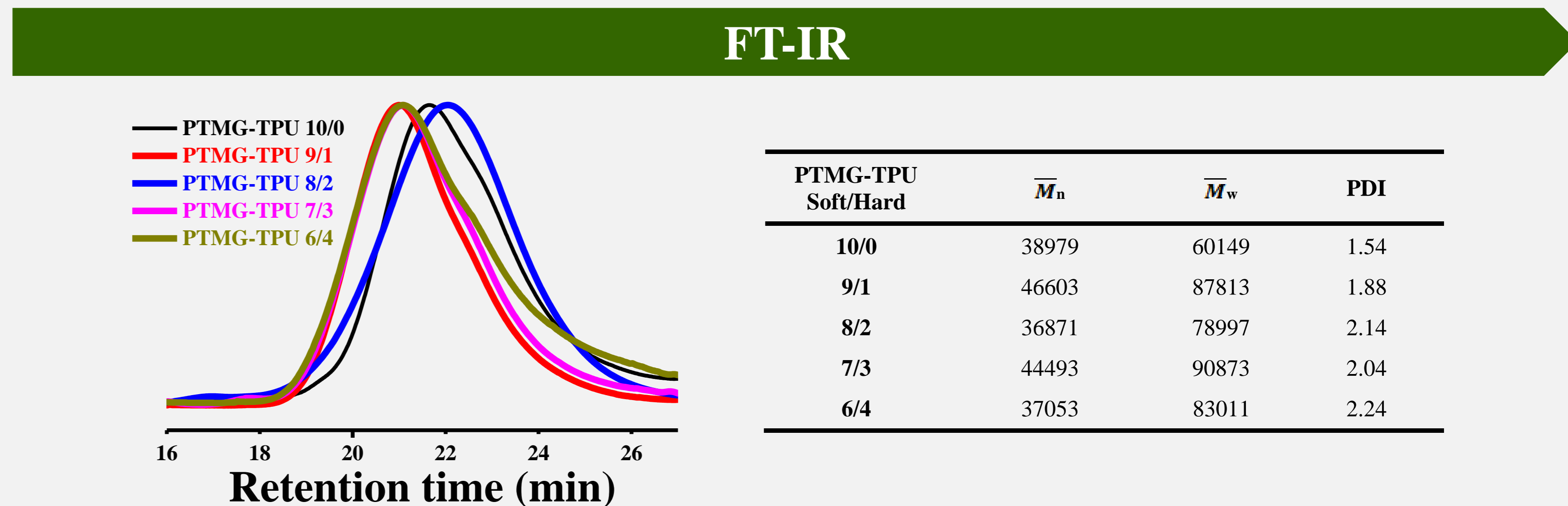
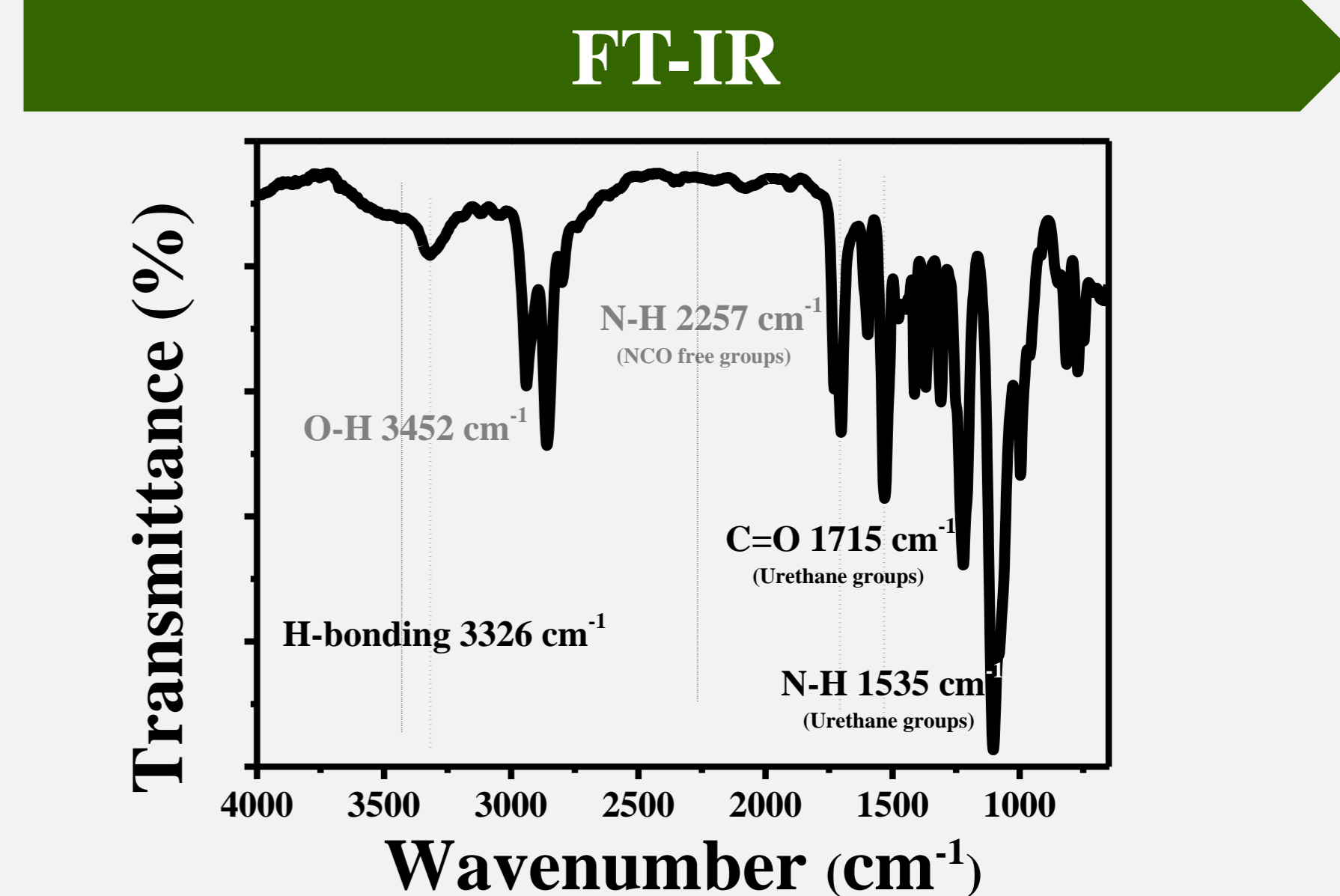
Table 1. Composition of the PUs.

Sample Code	Reactants (g)			
	MDI	PTMG	1,4-BD	MDI-2
PU 10/0	10.2582	39.7418	-	-
PU 9/1	9.2574	35.7426	1.3238	3.6761
PU 8/2	8.2566	31.7434	2.6477	7.3523
PU 7/3	7.2558	27.7442	3.9716	11.0284
PU 6/4	6.2549	23.7450	5.2954	14.7046



## Results

PTMG-PU (Soft : Hard)	Code name
10 : 0	PTMG-TPU 10/0
9 : 1	PTMG-TPU 9/1
8 : 2	PTMG-TPU 8/2
7 : 3	PTMG-TPU 7/3
6 : 4	PTMG-TPU 6/4



## Conclusion

- To study thermoplastic polyurethane for the application of an encapsulant in electronic devices, the PTMG-TPU comprised of different soft/hard ratios were synthesized under in-situ polymerization.
- The increased tensile strength may be due to the effects of significant hard-segment crystallinity or higher hard-domain volume fraction or strong hydrogen bonding.
- Water vapor permeability values of PTMG-TPU series varied from 223 to 116 g/m<sup>2</sup>·day (The best WVTR : 116 g/m<sup>2</sup>·day)

## Acknowledgement

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