

## Supporting Information

### Synthesis of Polyurethane with Mechanical Properties Responsive to Water Retention States

Xuemin Li<sup>a,b,c</sup>, Feng Ye<sup>\*a,c</sup>, Jie Wang<sup>\*a,d</sup>, Zhaobin Chen<sup>a,c</sup> and Xiaoniu Yang<sup>a,c</sup>

<sup>a</sup>State Key Laboratory of Polymer Physics and Chemistry, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, 5625 Renmin Street, Changchun 130022, P. R. China

<sup>b</sup>School of Applied Chemistry and Engineering, University of Science and Technology of China, Jinzhai Road No 96, Hefei 230026, P. R. China

<sup>c</sup>Polymer Composite Engineering Laboratory, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, 5625 Renmin Street, Changchun 130022, P. R. China

<sup>d</sup>Huangpu Institute of Advanced Materials, Changchun Institute of Applied Chemistry, Chinese Academy of Science, Guangzhou 510700, China

E-mail: [xnyang@ciac.ac.cn](mailto:xnyang@ciac.ac.cn)

[yefeng@ciac.ac.cn](mailto:yefeng@ciac.ac.cn)

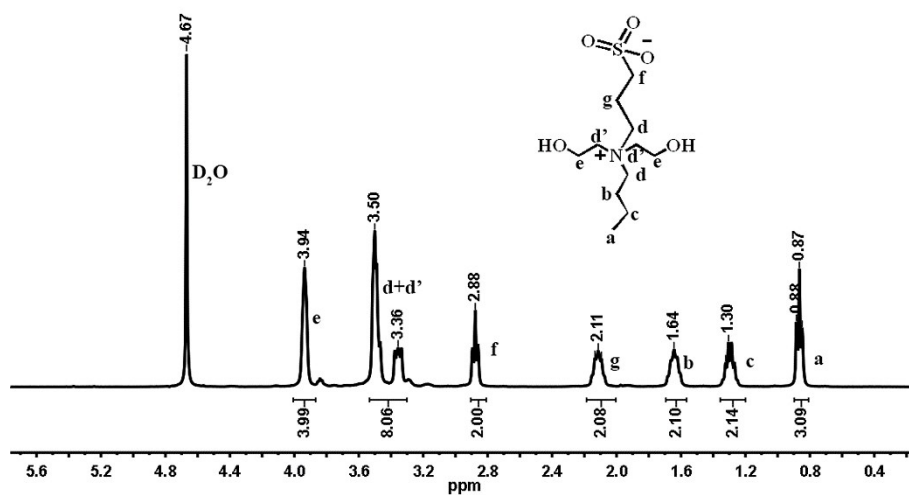


Figure S1. <sup>1</sup>H-NMR spectra of sulfobetaine.

Table S1 Composition and polymerization results of PU samples.

Sample	composition (relative mole ratio)				Mn ( $\times 10^4$ )	PDI
	HDI	BDO	PCL-diol	SB-diol		
PU-0	2	1	1	0	6.7	1.47
PU-25	2	1	0.75	0.25	14.9	1.53
PU-50	2	1	0.5	0.5	11.6	1.56
PU-75	2	1	0.25	0.75	16.0	1.54

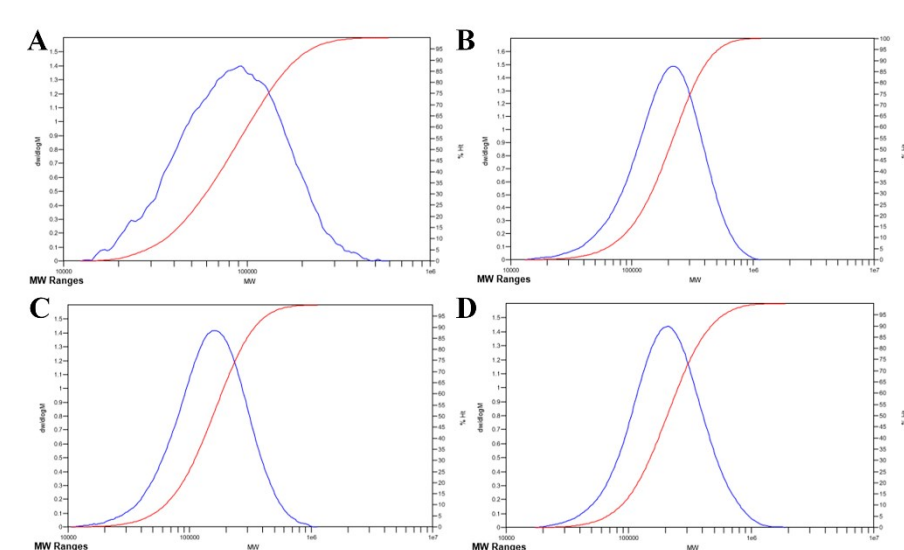


Figure S2. GPC curves of (A) PU-0, (B) PU-25, (C) PU-50 and (D) PU-75

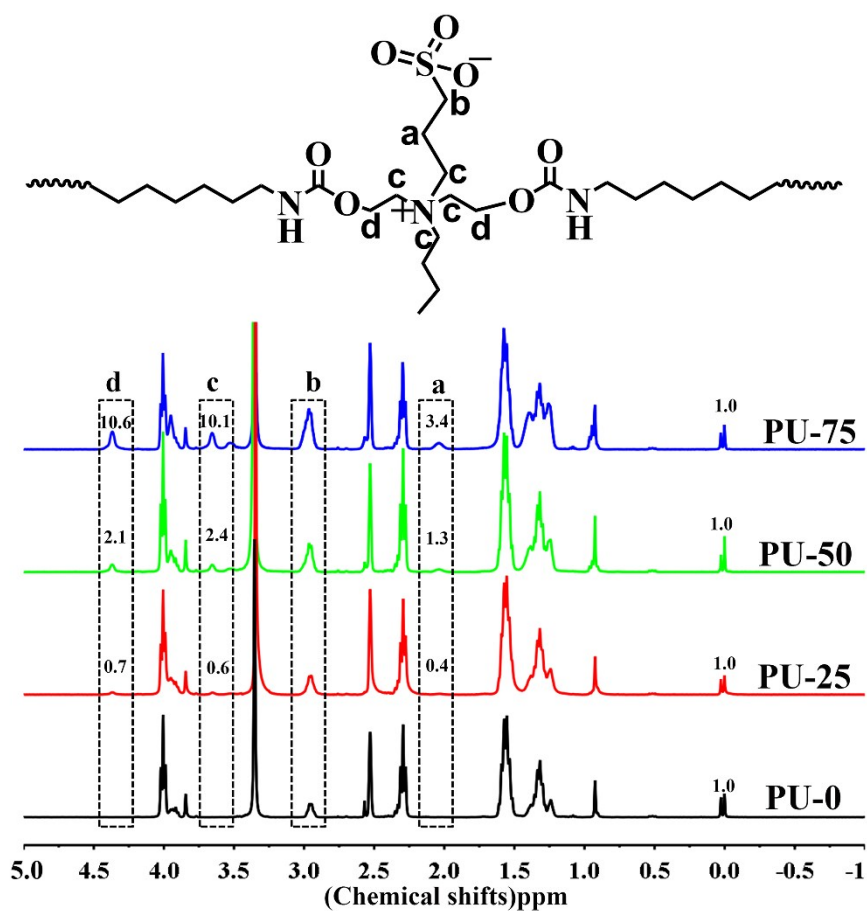


Figure S3. ATR-FTIR spectra of WRSRPU.

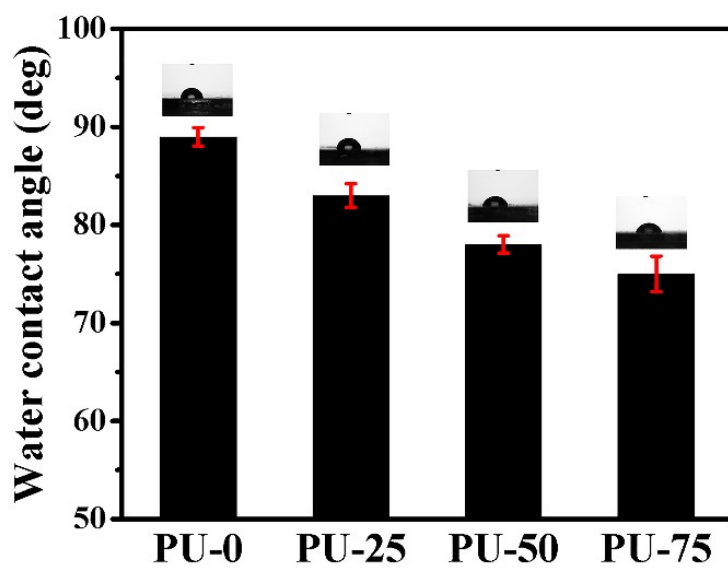


Figure S4. (A) Contact angle of WRSRPU.

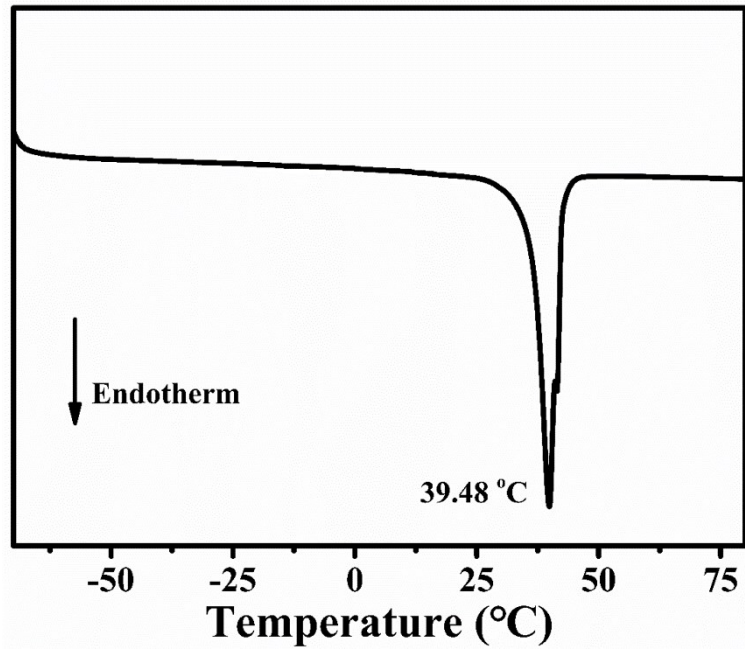


Figure S5. The DSC curves of pure PCL2000.

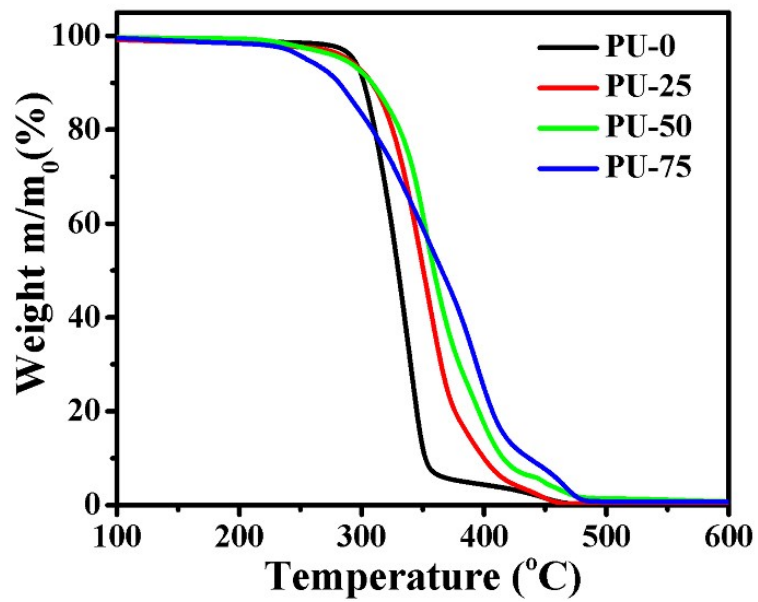


Figure S6. TGA curves of WRSRPU

Table S2. Mechanical Properties of WRSRPUs under dry and wet conditions.

sample	Tensile strength (MPa)		Strain at break (%)		Young's modulus (MPa)	
	dry	wet	dry	wet	dry	wet
PU-0	13.6±1.7	14.3±0.5	1338±104	1161±81	16.8±3.9	18.5±2.0
PU-25	41.1±2.4	34.6±2.7	1522±58	1322±57	23.7±1.5	14.2±0.5
PU-50	45.5±5.6	27.5±4.6	1193±114	1386±6	28.5±0.8	20.9±0.9
PU-75	53.6±4.1	23.7±4.1	759±41	1055±92	73.3±9.8	23.9±2.9

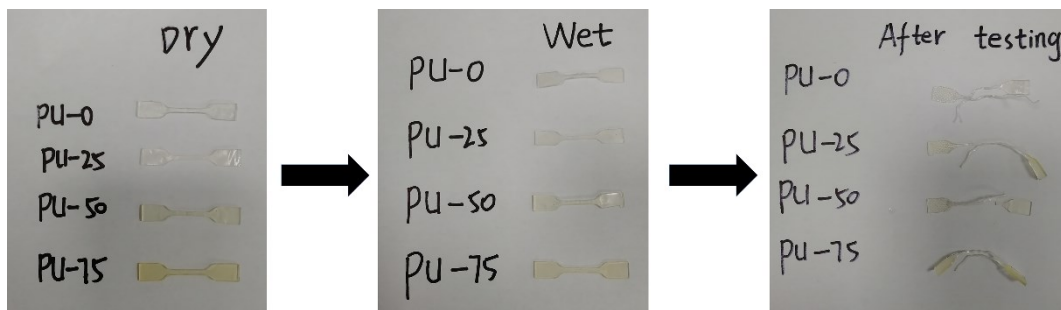


Figure S7 The digital image of WRSRPUs before and after tensile testing.

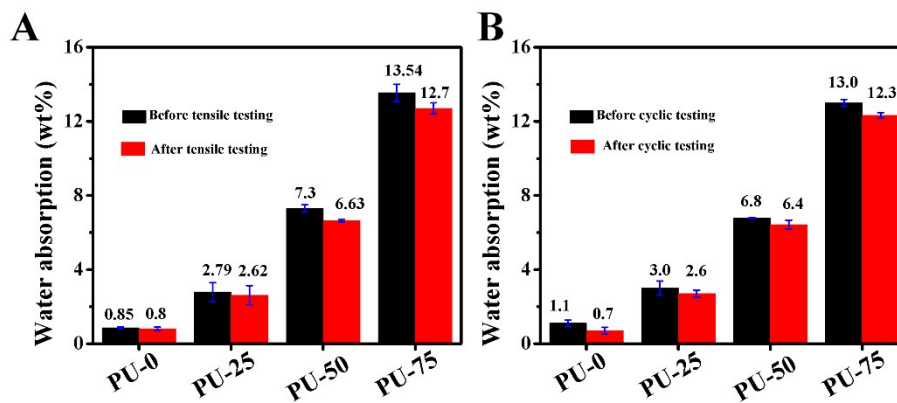


Figure S8 Water absorption in deionized water for 24 h before and after (A) tensile testing and (B) cyclic testing.

Table S3. Hysteresis loop area and Percent elastic recovery of WRSRPU after cycle 10 at 100% max strain

sample	strain			
	Hysteresis loss (%)		Hysteresis loop area (MPa)	
	dry	wet	dry	wet
PU-0	31.9	30.0	0.28	0.31
PU-25	26.0	27.7	0.47	0.26
PU-50	32.9	28.83	0.67	0.30
PU-75	65.1	27.8	1.67	0.30

Table S4. The depths of WRSRPU after 500  $\mu$ N under dry and wet conditions.

Sample	PU-0	PU-25	PU-50	PU-75
Depth(nm)				
dry	2564 $\pm$ 60	2448 $\pm$ 170	2043 $\pm$ 21	773 $\pm$ 12
wet	2200 $\pm$ 84	2623 $\pm$ 132	2324 $\pm$ 92	2131 $\pm$ 112

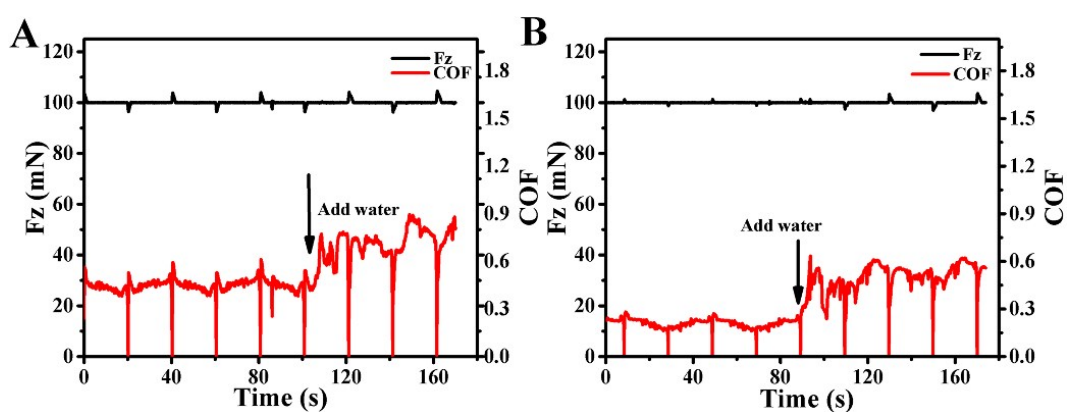


Figure S9. Friction coefficient - time curves of polyurethane films before and after adding water (A) PU-25 and (B) PU-50.

Table S5 The water absorption, Load and Loop area of PU-75 at different humidity for 4h.

<b>Humidity (%)</b>	<b>Original</b>	<b>55±6</b>	<b>75±7</b>	<b>95±3</b>
<b>Water absorption (%)</b>	-	1.0	6.04	10.1
<b>Load (μN)</b>	218.33±12.39	198.67±18.92	114.69±2.44	31.07±0.21
<b>Area (nm*μN)</b>	31422±572	29210±701	13839±994	3611±131

Table S6 The water absorption, Load and Loop area of PU-75 at 95% humidity under different time.

<b>Time (h)</b>	<b>Original</b>	<b>0.5</b>	<b>1</b>	<b>4</b>
<b>Water absorption (%)</b>	-	5.2	6.9	10.1
<b>Load (μN)</b>	218.33±12.39	93.55±10.53	67.89±9.15	31.07±0.21
<b>Area (nm*μN)</b>	31422±572	14893±810	11087±654	3611±131