Supporting Information

Sustainable and Tough Polyurethane Films with Self-healability and Flame-retardance Enabled by Reversible Chemistry and Cyclotriphosphazene

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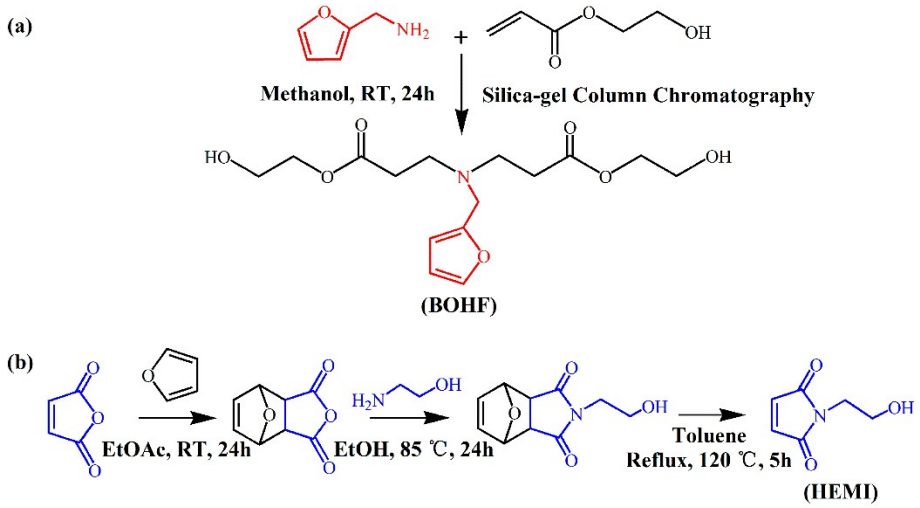

Scheme S1. Synthesis of (a), 2-[N, N-bis(propionic acid-2-hydroxy-ethyl ester) amino] furfuryl (BOHF); (b), N-(2-Hydroxyethyl)-maleimide (HEMI)

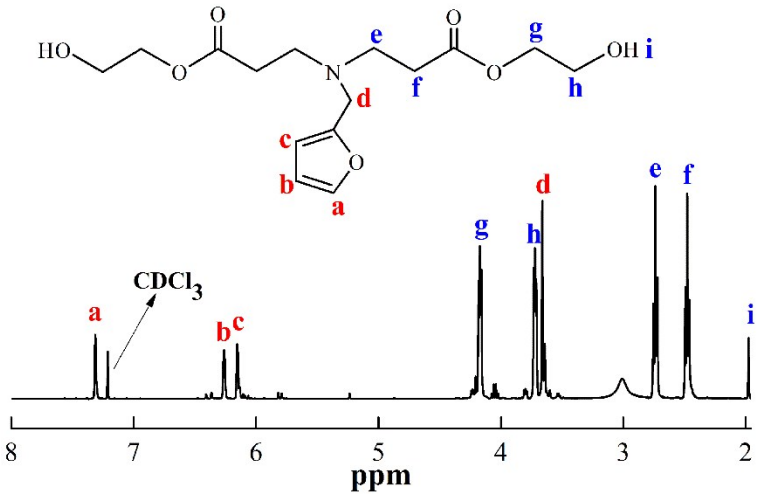

Figure S1. [1]H NMR spectrum of BOHF

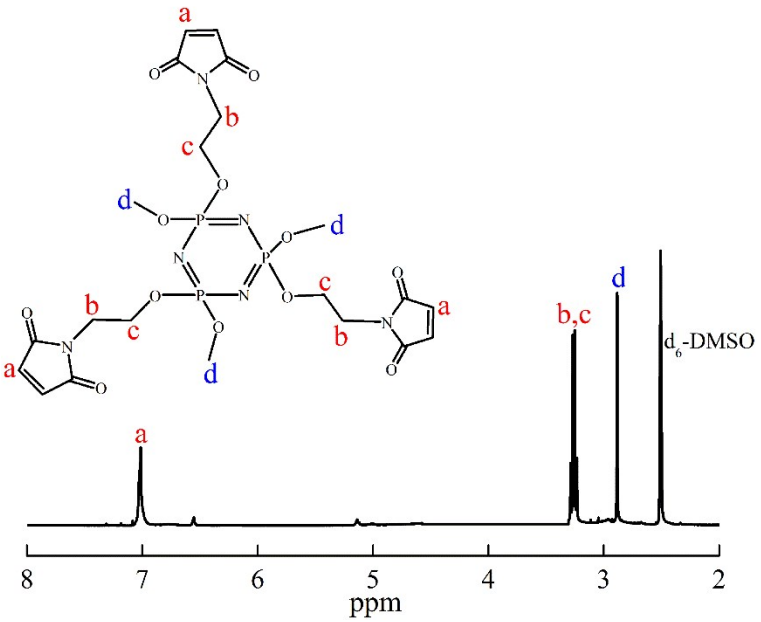

Figure S2. [1]H NMR spectrum of TMCP

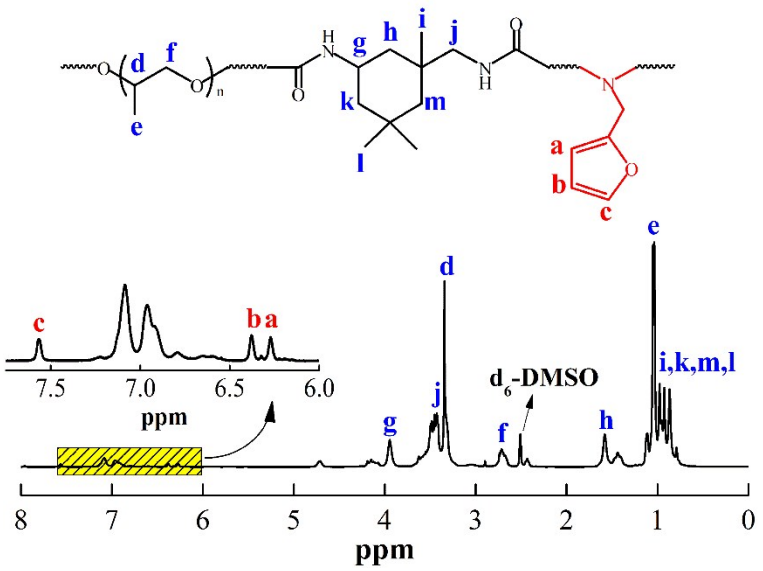

Figure S3. ^{1}H NMR spectrum of PUF

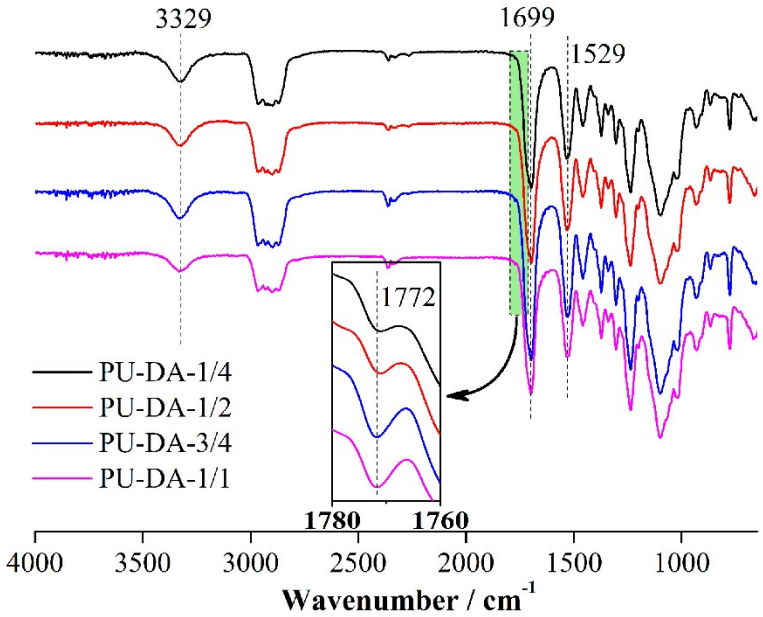

Figure S4. FTIR spectra of different PU-DA-x samples

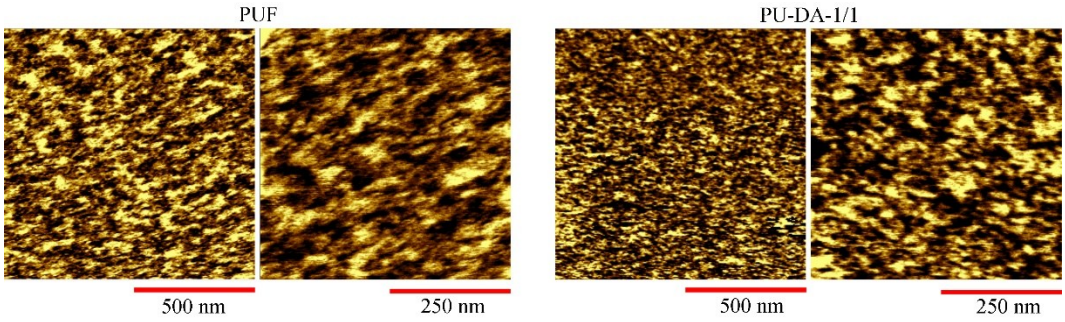

Figure S5. The AFM morphologies of PUF and PU-DA-1/1 film

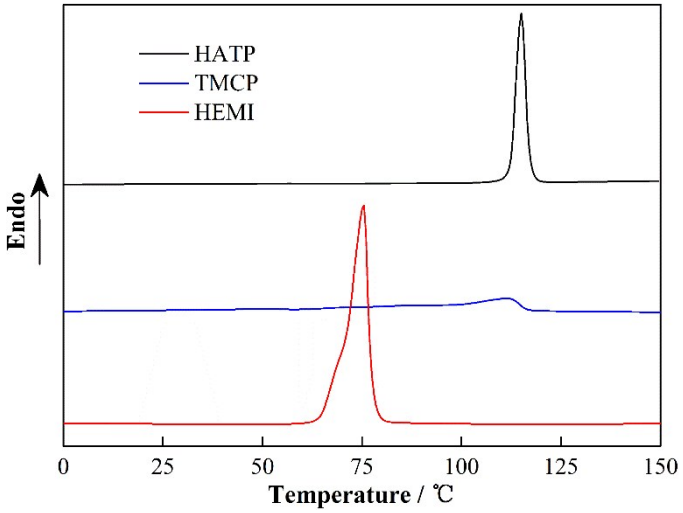

Figure S6. DSC curves of HATP, TMCP and HEMI

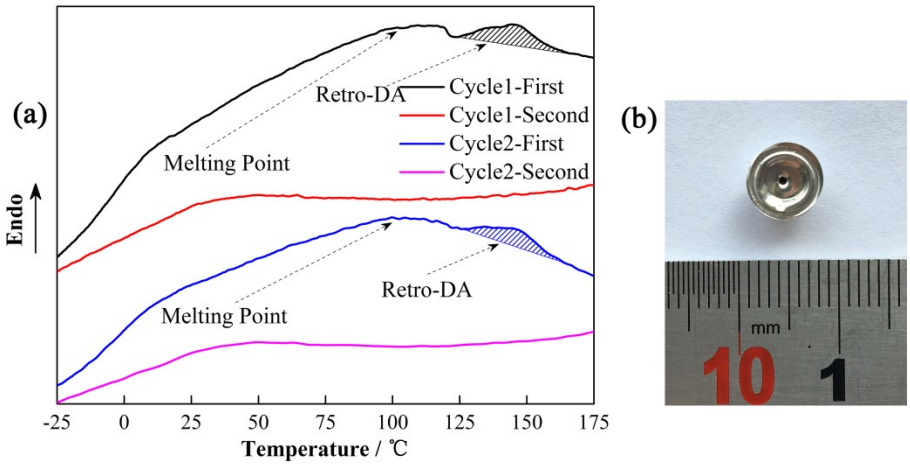

Figure S7. DSC curves of FUC film for the successively first and second heating program for

two cycles measurement

Table S1. Details of the tensile results of PUF and PU-DA-x

Samples	Young's Modulus (MPa)	Stress (MPa)	Strain (%)
PUF	1.06±0.31	4.60±0.78	828±68
PU-DA-1/4	1.42±0.25	7.30±0.86	728±35
PU-DA-1/2	1.86±0.19	8.45±0.76	605±27
PU-DA-3/4	3.19±0.16	9.80±0.30	585±18
PU-DA-1/1	7.76±0.09	13.49±0.79	525±30

Table S2. The breaking stress, breaking strain and Young's modulus of PU-DA-1/1, recycled PU-DA-1/1, PUC and recycled PUC

Samples	Breaking Stress (MPa)	Breaking Strain (%)	Young's Modulus (MPa)
PU-DA-1/1	13.49±0.79	526±30	7.76±0.09
Recycled PU-DA-1/1	10.29±0.68	488±63	4.96±0.21
PUC	18.12±1.12	461±57	8.65±0.33
Recycled PUC	1.79±0.23	75±21	3.63±0.27