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# Improving the Hydrolytic Stability of Aryl Cyanate Esters by Examining the Effects of Extreme Environments on Polycyanurate Copolymers

Alasdair O. Crawford, Gabriel Cavalli, Brendan J. Howlin, and Ian Hamerton\*



Fig. S1. Images of selected blends between 1-3.

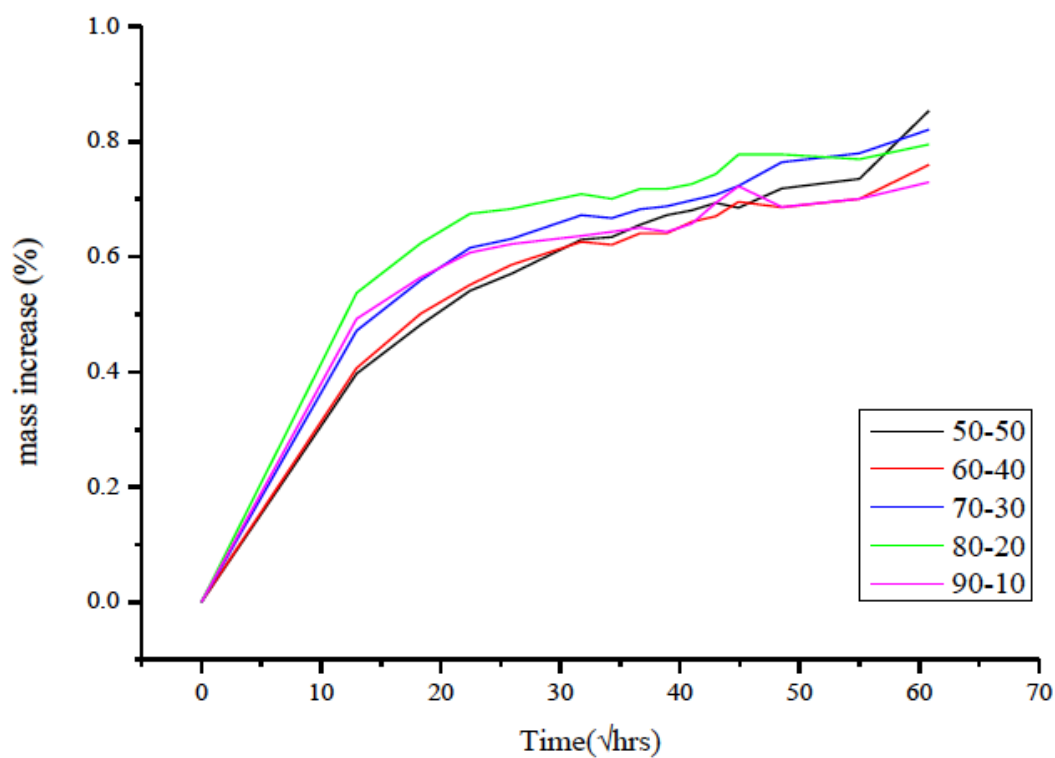


Fig. S2.  $[I_x-2_y]$  H<sub>2</sub>O absorbed (%) vs. time ( $\sqrt{\text{hrs}}$ ) at 75 % RH

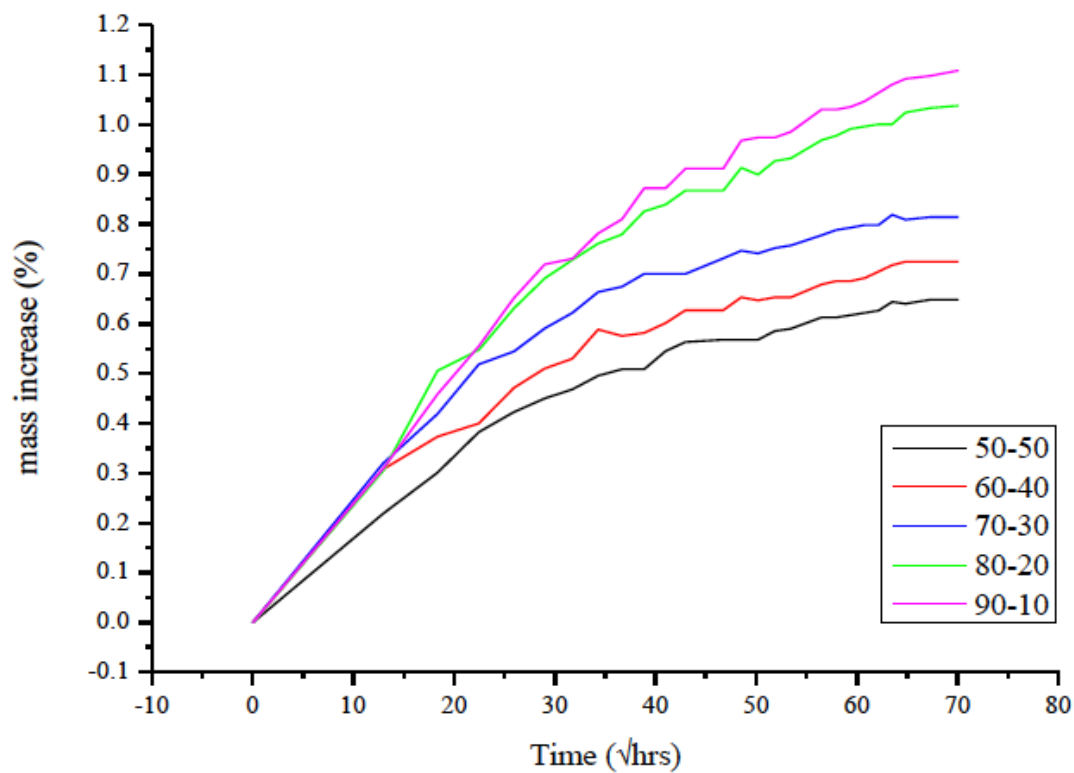


Fig. S3.  $[3_x-1_y]$  H<sub>2</sub>O absorbed (%) vs. time ( $\sqrt{\text{hrs}}$ ) at 75 % RH

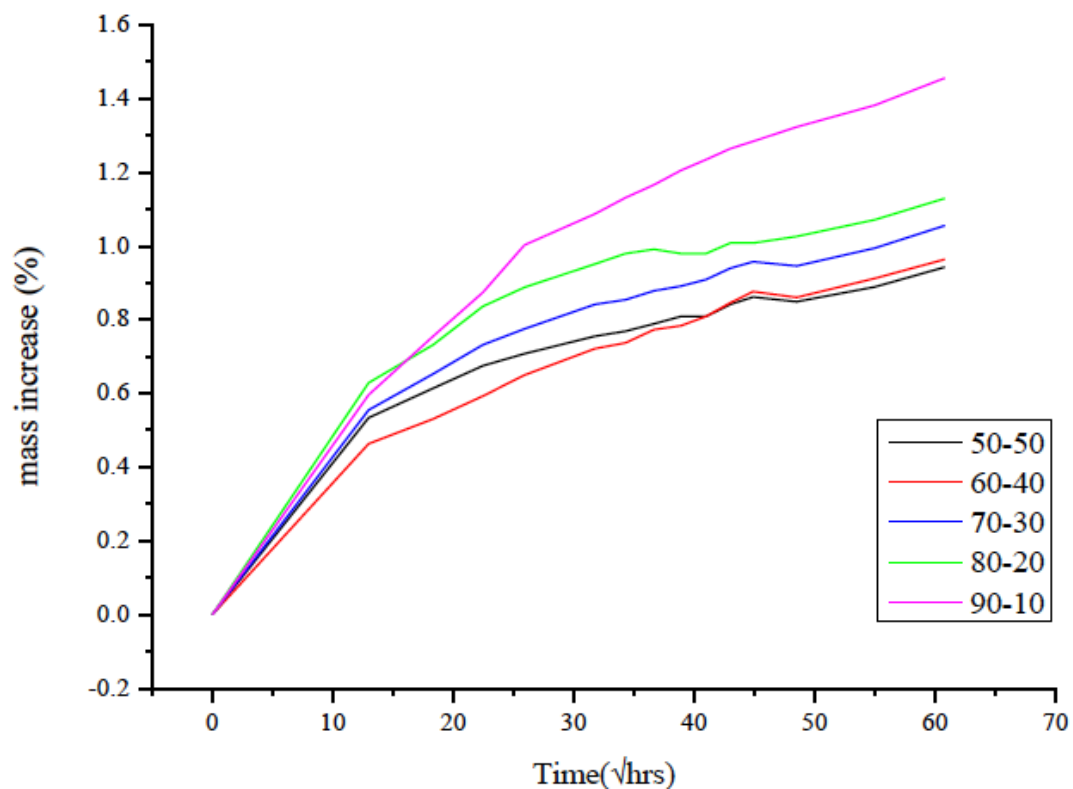


Fig. S4.  $[3_x-2_y]$  H<sub>2</sub>O absorbed (%) vs. time ( $\sqrt{\text{hrs}}$ ) at 75 % RH

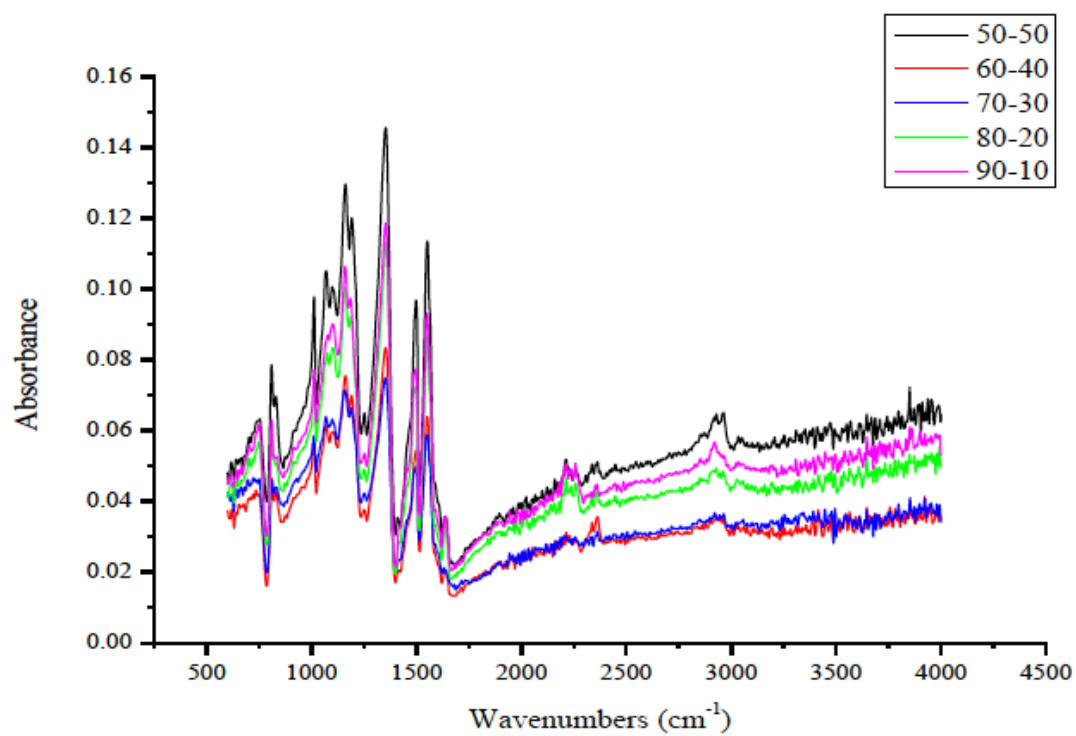


Fig. S5. Spectral analysis of  $[3_x-1_y]$

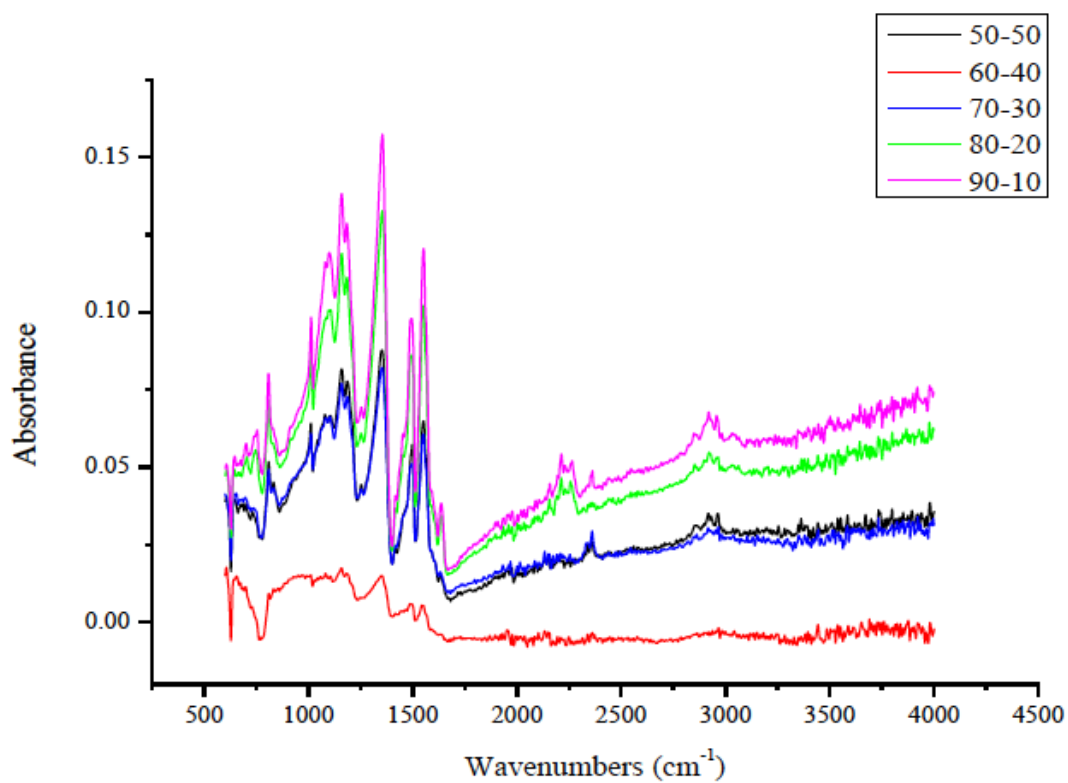


Fig. S6. Spectral analysis of  $[3_x-2_y]$

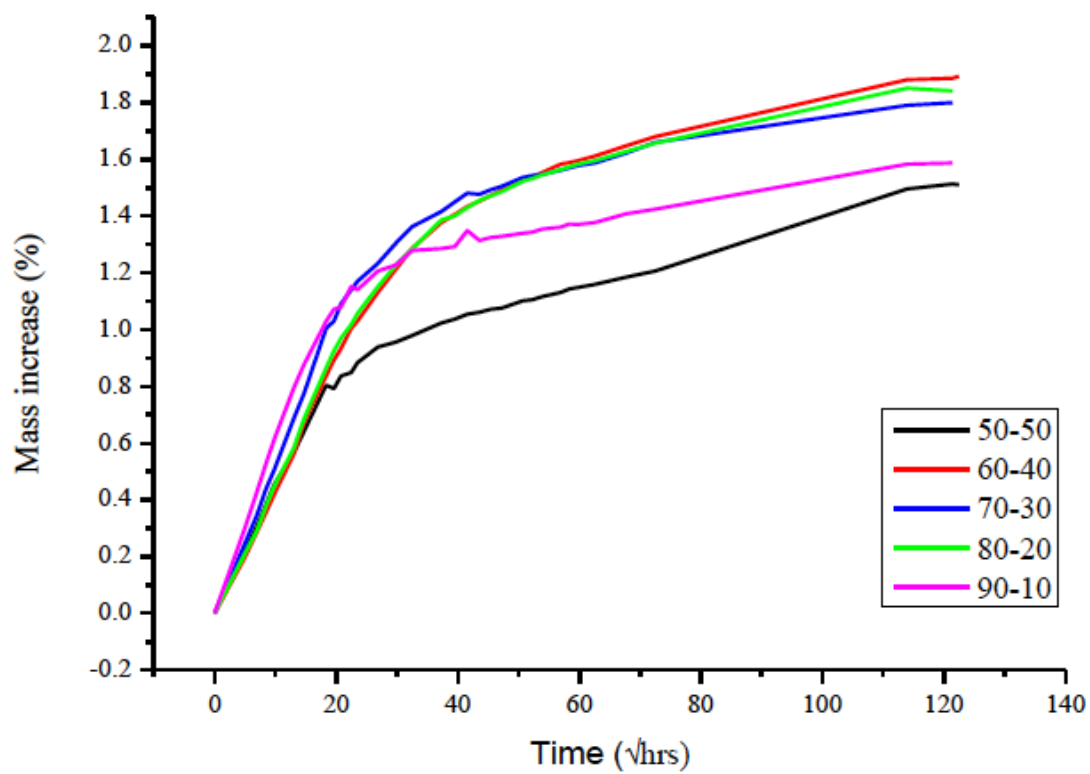


Fig. S7.  $[I_{x-2y}]$  H<sub>2</sub>O absorbed (%) vs. time ( $\sqrt{\text{hrs}}$ )

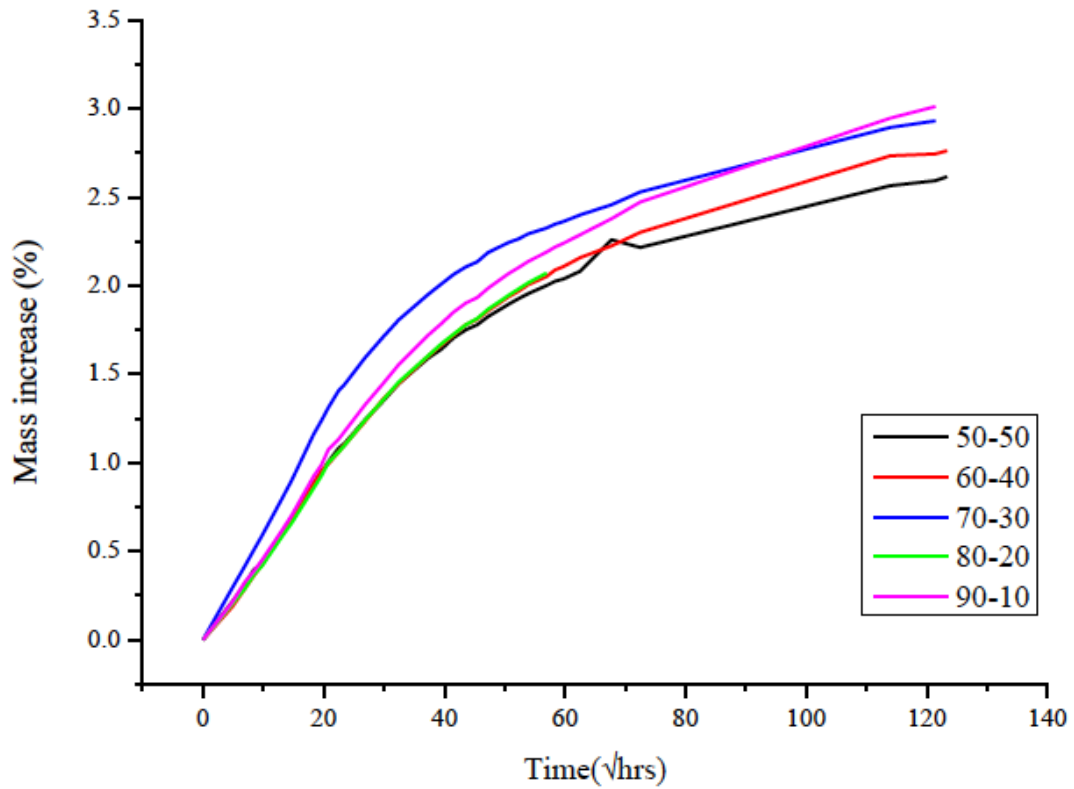


Fig. S8.  $[3_x-1_y]$  H<sub>2</sub>O absorbed (%) vs. time (√hrs)

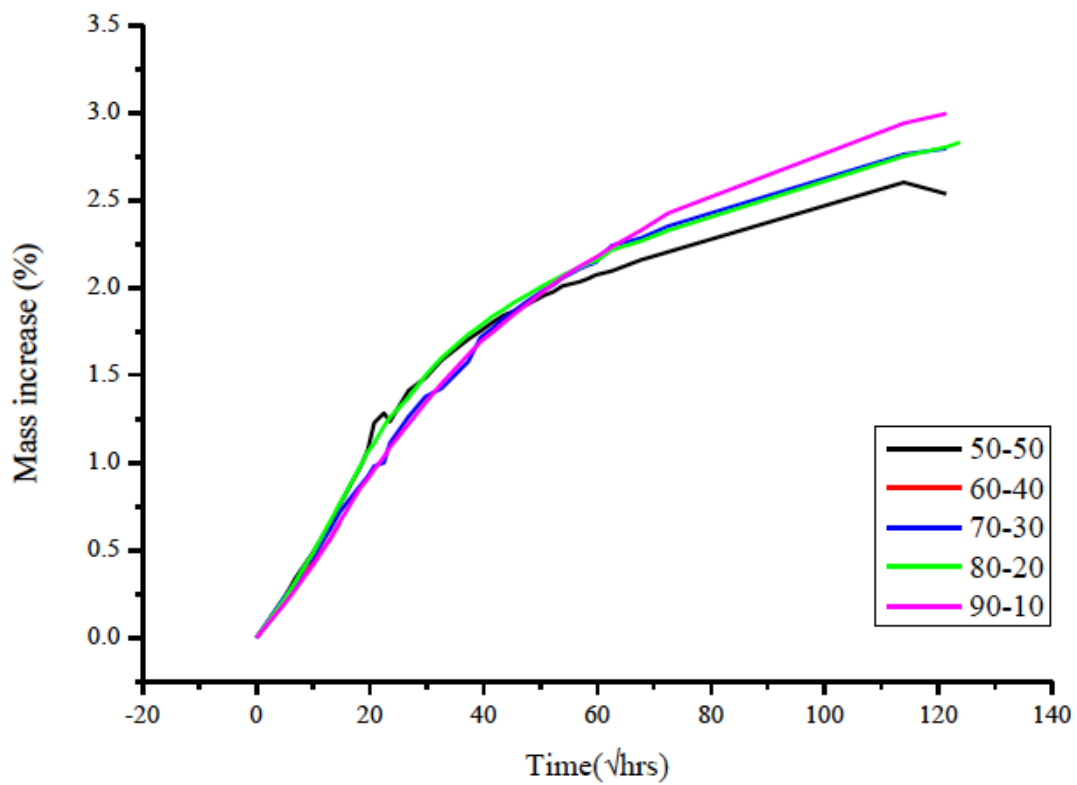


Fig. S9.  $[3_x-2_y]$  H<sub>2</sub>O absorbed (%) vs. time (√hrs)

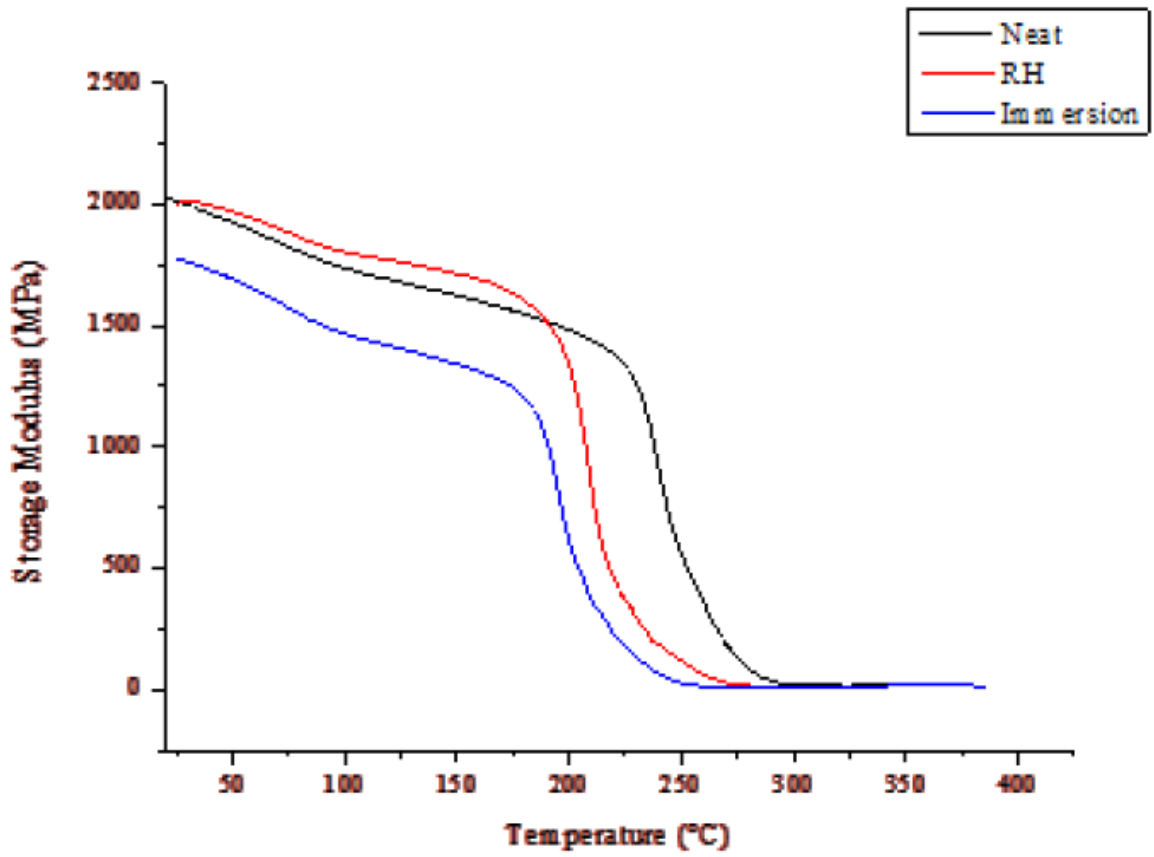
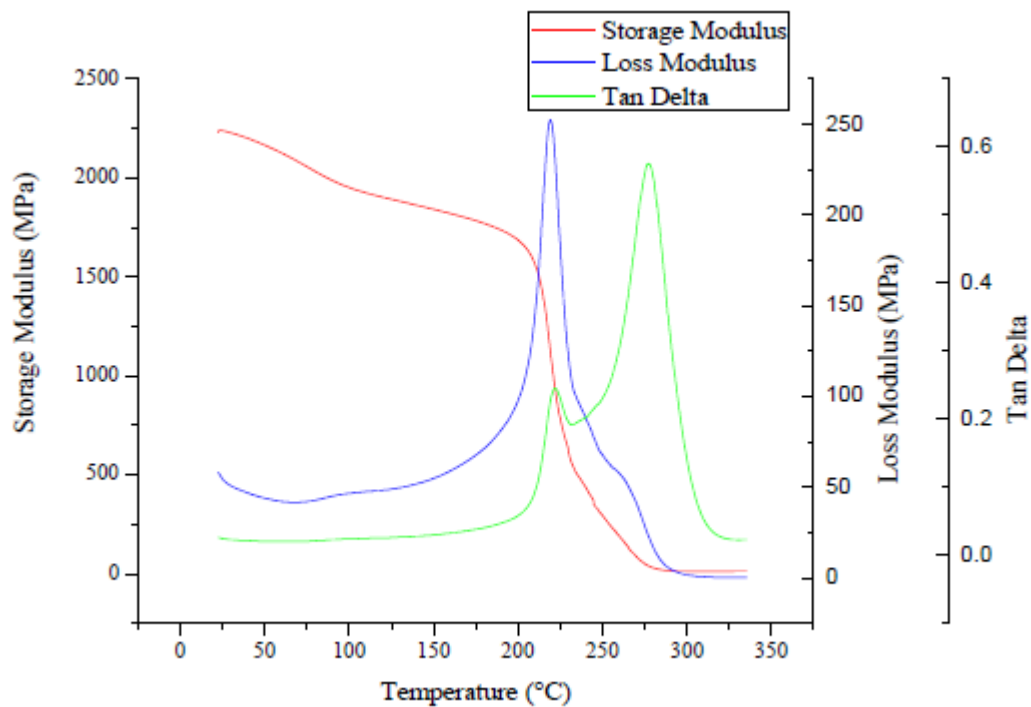
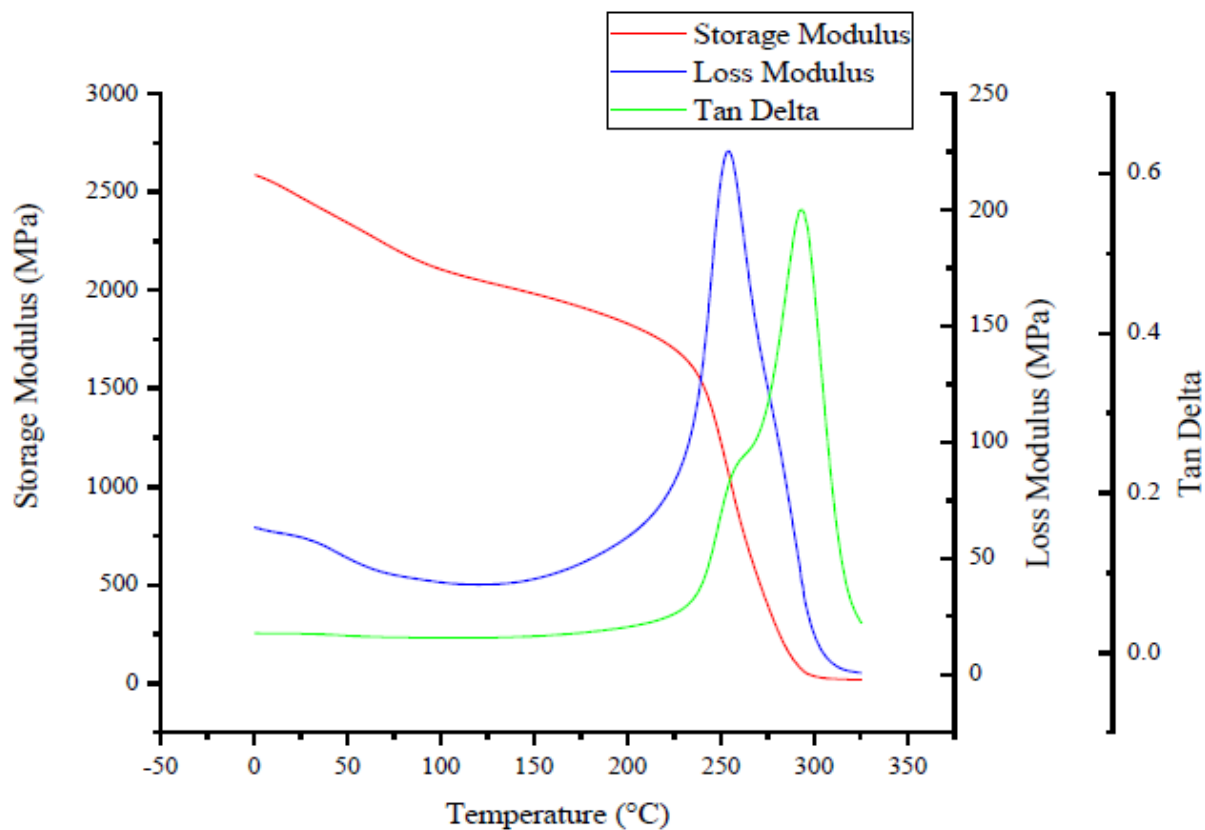
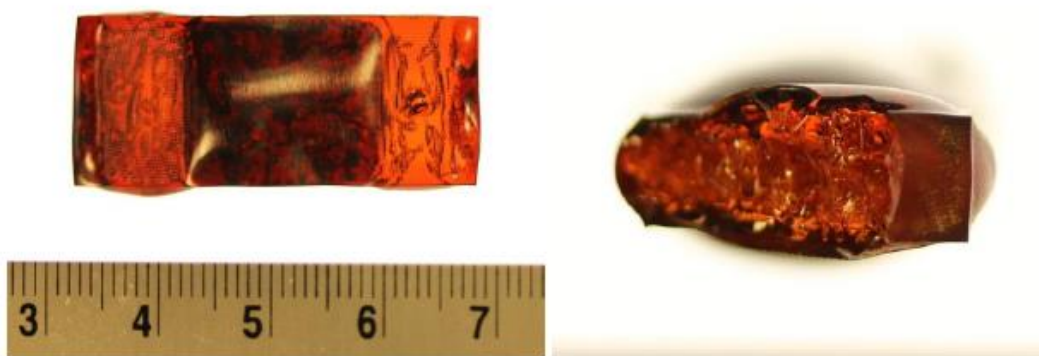


Fig. S10. DMTA data for unexposed (black), RH (red) and immersion (blue) for the blend [I<sub>50</sub>-2<sub>50</sub>] showing storage modulus as a function of temperature.

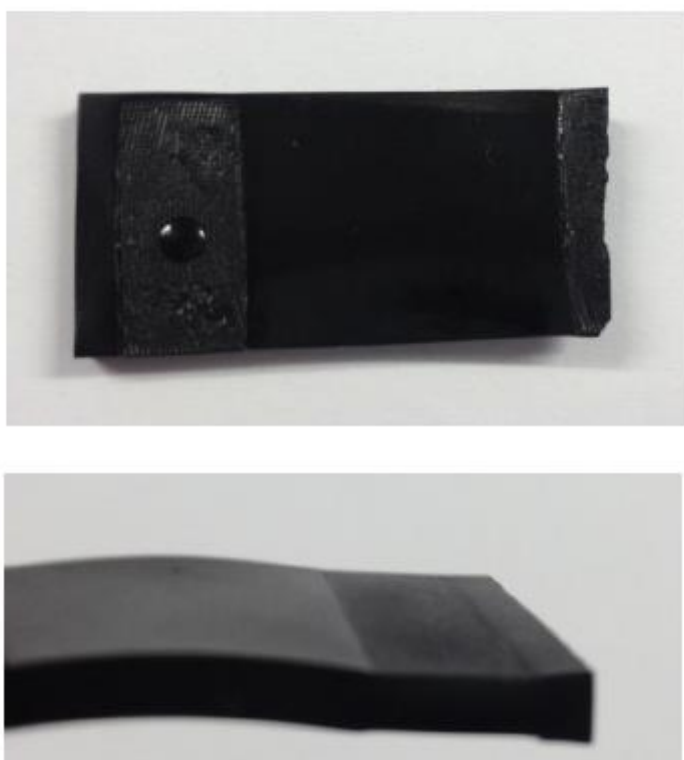


**Fig. S11 DMTA data for  $I_{70-230}$  (top) and  $[I_{70-230}]$  (bottom) showing storage and loss moduli as a function of temperature.**

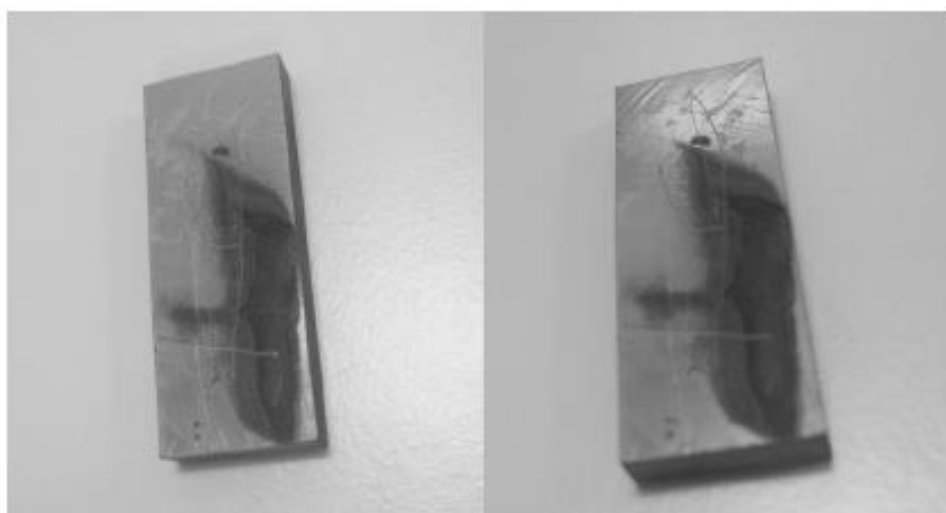




**Fig. S12 High resolution images of outgassing in [(1)<sub>50</sub>-(2)<sub>50</sub>]**



**Fig. S13 Top view (above) and side view (below) of [(3)<sub>90</sub>-(2)<sub>10</sub>] following exposure and DMTA.**



**Fig. S14 Basic (left) and Acidic (right) environments with immersed [(3)<sub>80</sub>-(2)<sub>20</sub>] (top), surface etching of [(3)<sub>80</sub>-(2)<sub>20</sub>] (bottom) following exposure to NaOH for 3192 hours.**

**Table S1. Mass uptakes observed in 75.3 % RH studies**

Material	Initial mass (M <sub>0</sub> )/g	Final mass (M <sub>i</sub> )/g	H <sub>2</sub> O absorption/%
<i>I</i> <sub>50-250</sub>	2.3344	2.3545	0.85
<i>I</i> <sub>60-240</sub>	1.9844	1.9996	0.76
<i>I</i> <sub>70-230</sub>	1.9211	1.9370	0.82
<i>I</i> <sub>80-220</sub>	1.1480	1.1572	0.80
<i>I</i> <sub>90-210</sub>	1.3742	1.3843	0.73
<b>3</b> <sub>50-150</sub>	2.1897	2.2040	0.65
<b>3</b> <sub>60-140</sub>	1.5209	1.5320	0.72
<b>3</b> <sub>70-130</sub>	1.9007	1.9163	0.81
<b>3</b> <sub>80-120</sub>	2.1262	2.1485	1.04
<b>3</b> <sub>90-110</sub>	1.7388	1.7583	1.11
<b>3</b> <sub>50-250</sub>	1.4718	1.4858	0.94
<b>3</b> <sub>60-240</sub>	1.9115	1.9301	0.96
<b>3</b> <sub>70-230</sub>	1.6132	1.6304	1.06
<b>3</b> <sub>80-220</sub>	1.7078	1.7273	1.13
<b>3</b> <sub>90-210</sub>	1.9839	2.0132	1.46

**Table S2. Mass uptake observed in direct immersion studies**

Material	Initial mass (M <sub>0</sub> ) /g	Final mass (M <sub>i</sub> ) /g	H <sub>2</sub> O absorption/ %
<i>I</i> <sub>50-250</sub>	8.9461	9.0833	1.51
<i>I</i> <sub>60-240</sub>	13.5747	13.8366	1.89
<i>I</i> <sub>70-230</sub>	10.6314	10.827	1.81
<i>I</i> <sub>80-220</sub>	12.9197	13.1641	1.86
<i>I</i> <sub>90-210</sub>	7.5177	7.6385	1.58
<b>3</b> <sub>50-150</sub>	17.2649	17.7285	2.61
<b>3</b> <sub>60-140</sub>	17.3742	17.8680	2.76
<b>3</b> <sub>70-130</sub>	12.7562	13.1457	2.96
<b>3</b> <sub>80-120</sub>	15.4618	15.9268	2.92
<b>3</b> <sub>90-110</sub>	13.8261	14.2588	3.03
<b>3</b> <sub>50-250</sub>	13.5108	13.8650	2.55
<b>3</b> <sub>60-240</sub>	17.2138	17.6260	2.34
<b>3</b> <sub>70-230</sub>	15.4747	15.9267	2.84
<b>3</b> <sub>80-220</sub>	11.8710	12.2167	2.83
<b>3</b> <sub>90-210</sub>	15.6982	16.1960	3.07

**Table S3.** Thermogravimetric data for cured binary cyanate ester blends as determined by TGA (nitrogen, 10 K/minute)

Sample	Mass Loss at Temperature (°C)							Y <sub>C</sub> (%)
	5 %	10 %	20 %	30 %	40 %	50 %	60 %	
<i>1</i>	413	423	428	435	458	538	575	1.83
<i>2</i>	417	422	430	452	530	571	588	1.89
<i>3</i>	423	434	522	595	620	635	650	1.76
<i>I<sub>50-2</sub><sub>50</sub></i>	414	422	427	436	484	549	576	2.03
<i>I<sub>60-2</sub><sub>40</sub></i>	411	419	421	422	429	470	551	1.54
<i>I<sub>70-2</sub><sub>30</sub></i>	416	425	427	436	470	542	570	1.45
<i>I<sub>80-2</sub><sub>20</sub></i>	413	425	430	438	489	552	579	1.22
<i>I<sub>90-2</sub><sub>10</sub></i>	410	424	428	435	458	530	552	1.76
<i>I<sub>30-2</sub><sub>50</sub></i>	416	425	441	522	572	595	608	1.38
<i>I<sub>60-2</sub><sub>40</sub></i>	419	426	460	552	592	610	622	1.59
<i>3<sub>70-1</sub><sub>30</sub></i>	420	429	498	573	604	621	635	1.65
<i>3<sub>80-1</sub><sub>20</sub></i>	420	431	498	578	609	625	640	1.33
<i>3<sub>90-1</sub><sub>10</sub></i>	419	434	515	585	603	619	633	1.67
<i>3<sub>50-2</sub><sub>50</sub></i>	420	430	484	558	592	608	621	1.41
<i>3<sub>60-2</sub><sub>40</sub></i>	420	432	489	560	594	612	624	1.75
<i>3<sub>70-2</sub><sub>30</sub></i>	408	423	429	487	555	587	604	1.47
<i>3<sub>80-2</sub><sub>20</sub></i>	420	434	513	574	603	619	633	1.58
<i>3<sub>90-2</sub><sub>10</sub></i>	418	433	508	566	597	614	628	1.34

Y<sub>C</sub> = Char yield measured at 800 °C

**Table S4. Mass uptakes observed in acid/base studies**

Material	Initial mass (M <sub>0</sub> ) /g		Final mass (M <sub>i</sub> ) /g		Mass change /%	
	H <sub>2</sub> SO <sub>4</sub>	NaOH	H <sub>2</sub> SO <sub>4</sub>	NaOH	H <sub>2</sub> SO <sub>4</sub>	NaOH
<i>I</i> <sub>50-250</sub>	2.086	2.208	2.1097	2.2348	+1.01	+1.01
<i>I</i> <sub>60-240</sub>	1.672	1.449	1.6915	1.4670	+1.01	+1.01
<i>I</i> <sub>70-230</sub>	2.289	2.363	2.1350	2.3897	+1.01	+1.01
<i>I</i> <sub>80-220</sub>	1.892	1.768	1.9118	1.7904	+1.01	+1.02
<i>I</i> <sub>90-210</sub>	0.641	0.481	0.6460	0.4865	+1.01	+1.01
<i>3</i> <sub>50-150</sub>	1.776	1.750	1.7950	1.7700	+1.01	+1.01
<i>3</i> <sub>60-140</sub>	1.816	2.370	1.8365	2.4016	+1.01	+1.01
<i>3</i> <sub>70-130</sub>	2.217	1.458	2.2395	1.4773	+1.01	+1.01
<i>3</i> <sub>80-120</sub>	1.909	2.427	1.9307	2.4620	+1.01	+1.01
<i>3</i> <sub>90-110</sub>	1.720	1.889	1.7388	1.9242	+1.01	+1.02
<i>3</i> <sub>50-250</sub>	1.254	1.327	1.2648	1.3380	+1.01	+1.01
<i>3</i> <sub>60-240</sub>	1.335	0.970	1.3462	0.9810	+1.01	+1.01
<i>3</i> <sub>70-230</sub>	1.930	2.052	1.946	2.0761	+1.01	+1.01
<i>3</i> <sub>80-220</sub>	1.703	1.671	1.7265	1.6909	+1.01	+1.01
<i>3</i> <sub>90-210</sub>	1.523	1.398	1.5408	1.4282	+1.01	+1.02