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Article

Curing Behavior, Rheological, and Thermal Properties of DGEBA Modified with Synthesized BPA/PEG Hyperbranched Epoxy after Their Photo-Initiated Cationic Polymerization

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Supplementary Material

Table 1. The density of each sample cured at various UV intensity.

UV intensity (mW/cm²)	Density (g/cm³)	
	DGEBA	D90H10
10	$1.0000 \pm 2\times10^{-6}$	$1.0000 \pm 1\times10^{-5}$
20	$1.0000 \pm 9\times10^{-8}$	$1.0000 \pm 5\times10^{-6}$
30	$1.0000 \pm 1\times10^{-5}$	$1.0000 \pm 5\times10^{-6}$
40	$1.0000 \pm 1\times10^{-5}$	$1.0000 \pm 5\times10^{-6}$
50	$1.0002 \pm 4\times10^{-4}$	$1.0002 \pm 3\times10^{-4}$

Table 2. Parameters from Zimm plot for DGEBA and D90H10 at various UV intensity.

UV intensity (mW/cm²)	Slope	Intercept	I_0	ξ (nm)	R_g (nm)
DGEBA					
10	55.547 ± 0.440	0.009 ± 0.000	108.042 ± 1.349	7.747 ± 0.079	13.42 ± 0.14
20	54.391 ± 0.004	0.021 ± 0.000	48.567 ± 0.000	5.140 ± 0.000	8.90 ± 0.00
30	39.715 ± 0.063	0.027 ± 0.000	37.290 ± 0.021	3.848 ± 0.004	6.67 ± 0.01
40	45.547 ± 0.344	0.024 ± 0.000	41.289 ± 0.148	4.337 ± 0.024	7.51 ± 0.04
50	45.315 ± 0.003	0.024 ± 0.000	40.866 ± 0.000	4.303 ± 0.000	7.45 ± 0.00
D90H10					
10	52.440 ± 0.004	0.022 ± 0.000	44.783 ± 0.000	4.846 ± 0.000	8.39 ± 0.00
20	54.257 ± 0.004	0.020 ± 0.000	50.454 ± 0.000	5.232 ± 0.000	9.06 ± 0.00
30	66.274 ± 1.067	0.006 ± 0.000	176.712 ± 9.418	10.821 ± 0.377	18.74 ± 0.65
40	60.648 ± 0.004	0.016 ± 0.000	64.350 ± 0.000	6.247 ± 0.000	10.82 ± 0.00
50	58.156 ± 0.005	0.023 ± 0.000	44.131 ± 0.000	5.066 ± 0.000	8.77 ± 0.00

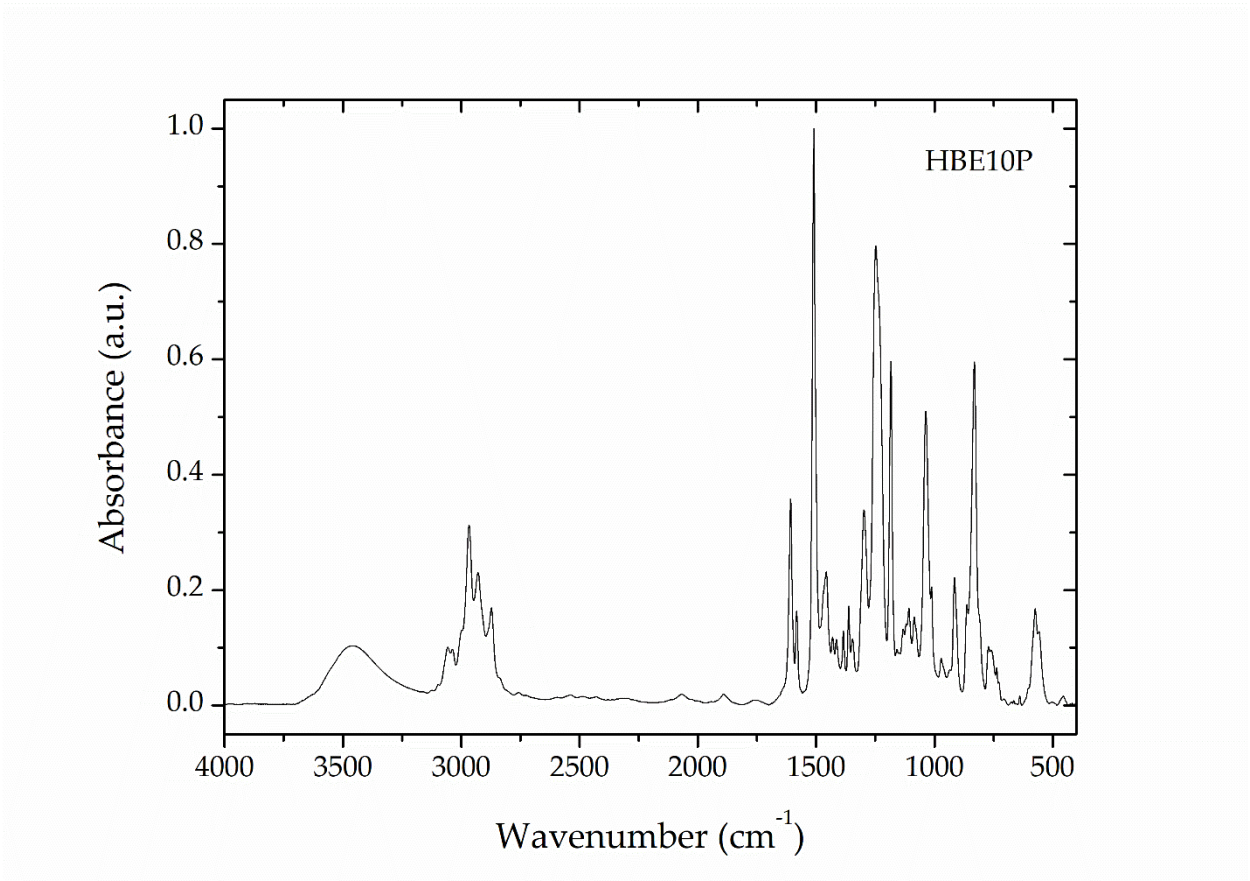

Figure 1. FTIR spectra of HBE10P resin.

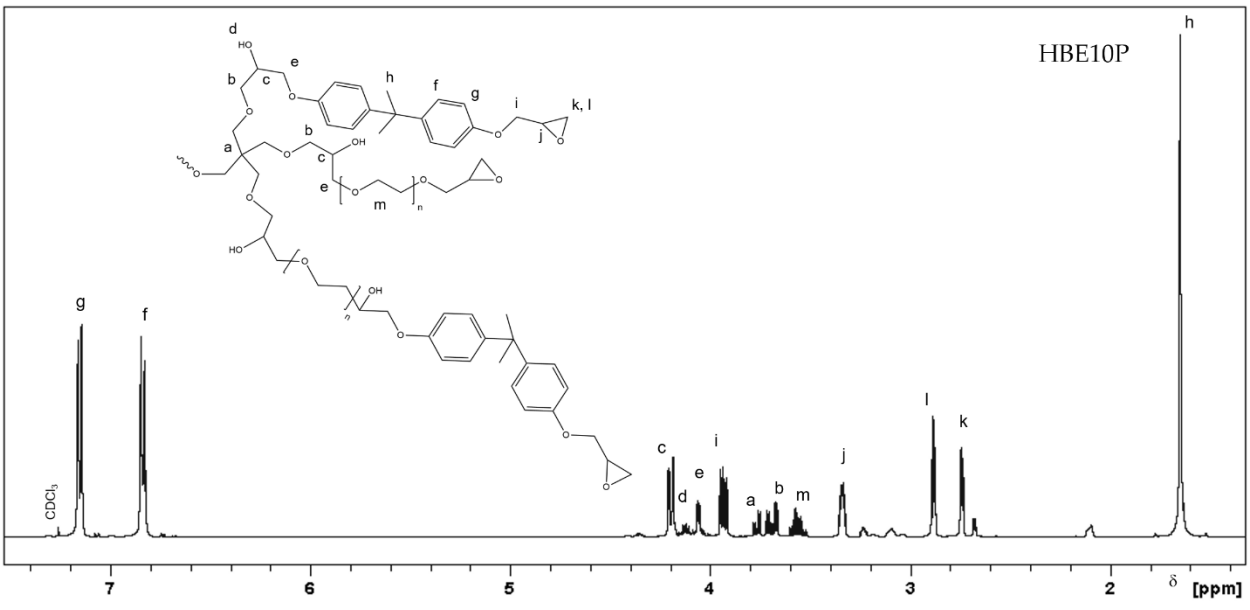

Figure 2. ^{1}H NMR spectrum of HBE10P resin.

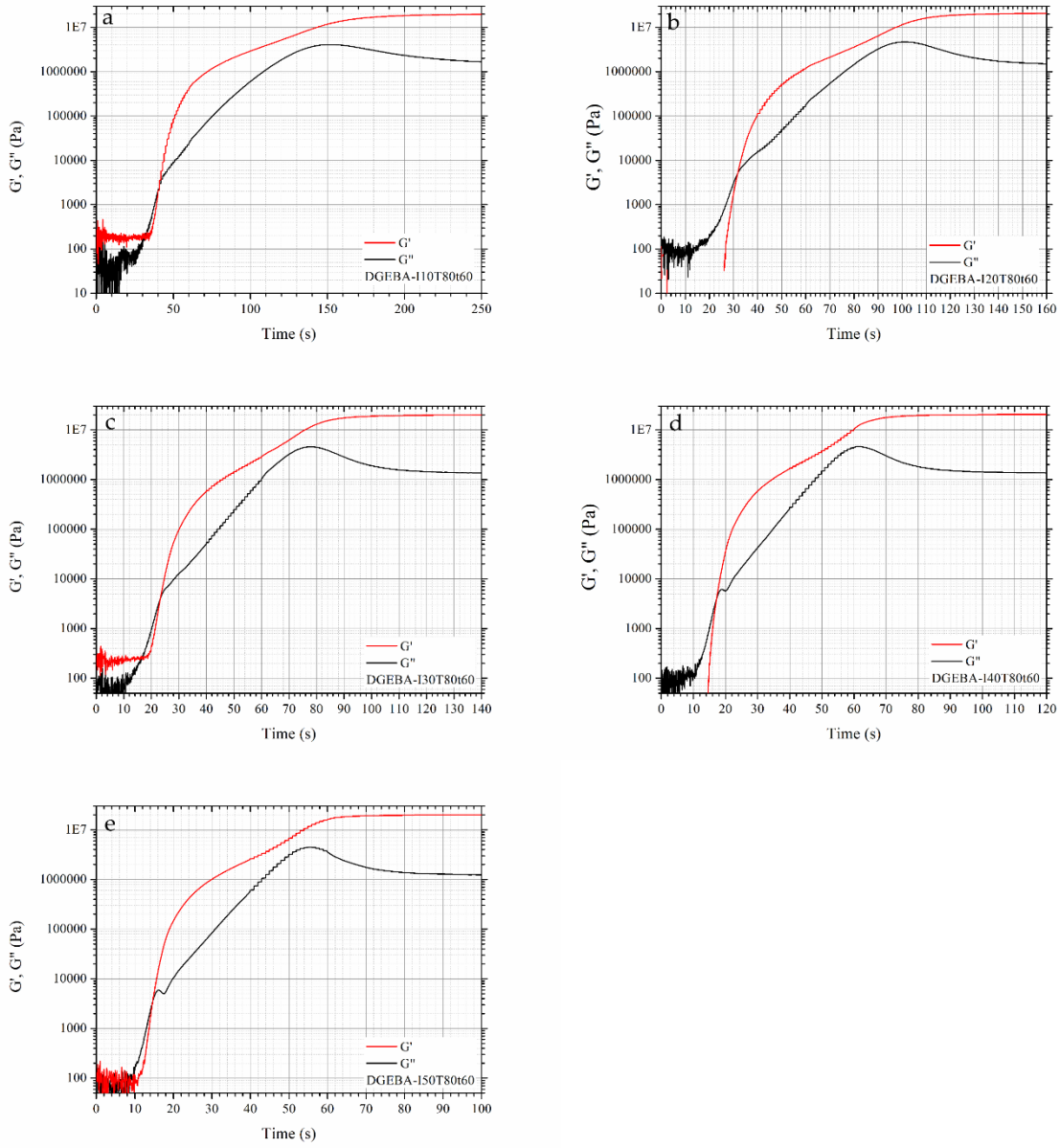

Figure 3. Crossover of storage modulus (G′) and loss modulus (G″) of DGEBA system at various curing conditions: (**a**) 10 mW/cm² (**b**) 20 mW/cm² (**c**) 30 mW/cm² (**d**) 40 mW/cm² and (**e**) 50 mW/cm².

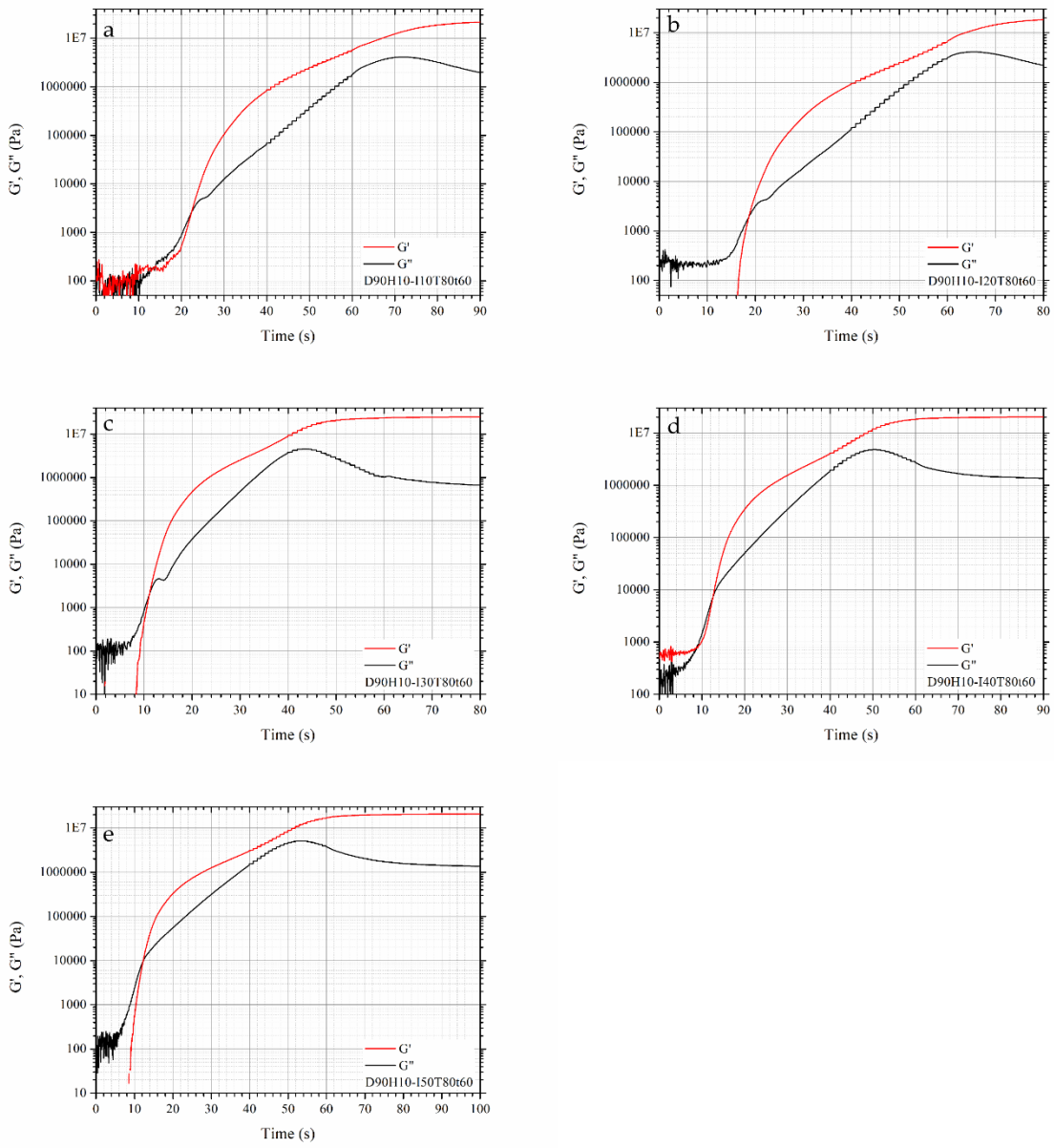

Figure 4. Crossover of storage modulus (G′) and loss modulus (G″) of D90H10 system at various curing conditions: (**a**) 10 mW/cm² (**b**) 20 mW/cm² (**c**) 30 mW/cm² (**d**) 40 mW/cm² and (**e**) 50 mW/cm².

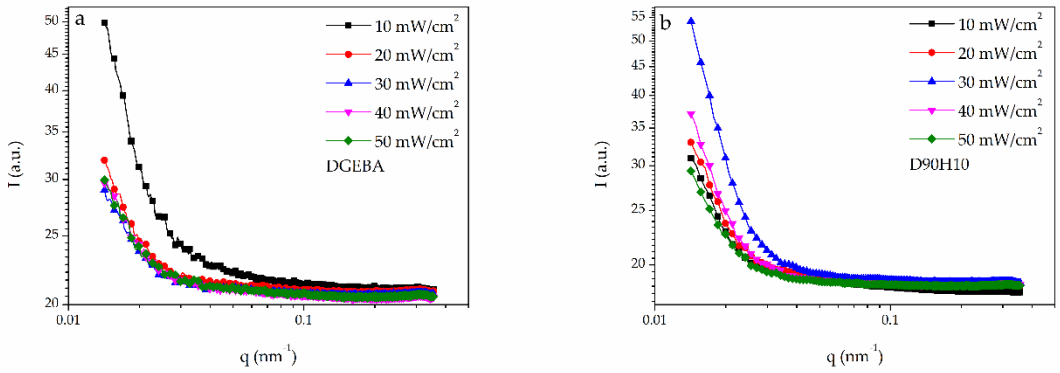

Figure 5. SAXS profiles of (**a**) DGEBA and (**b**) D90H10 cured at various UV intensity.

Figure 6. (**a**) DSC and (**b**) Rheometer instruments equipped with UV light guide.

Abbreviations

DGEBA	Diglycidyl ether of bisphenol A
BPA	Bisphenol A
PEG	Polyethylene glycol
HBE10P	Hyperbranched epoxy resin consisting of 10 wt% PEG
D90H10	Resin having DGEBA and HBE10P ratio to 90:10 wt/wt
ACE	Activated chain end mechanism
AM	Activated monomer mechanism
DSC	Differential scanning calorimetry
UV	Ultraviolet
SAXS	Small-angle X-ray scattering (SAXS)
RB	Round-bottom flask having a spherical bottom