

Figure S1: a) Storage modulus and b) loss tangent as a function of temperature for PPGDE 640/D4000 with DBP solvent loadings from 0 – 60 mass %.

Near Infrared (NIR) Analysis of Epoxy Amine Reaction

Near Infrared spectroscopy was used to monitor the epoxy-amine reaction progress. Specifically, we monitored the disappearance of the following previously assigned peaks:

4530 cm^{-1} ~ epoxy stretching and bending¹

4925 cm^{-1} ~ primary amine²

6080 cm^{-1} ~ epoxy stretching¹

6570 and 6670 cm^{-1} ~ combination of primary and secondary amine vibrations¹

NIR of D230 w/ 0 % DBP

Figure S2 shows the changes in the FTIR spectrum of a D230 / PPGDE640 sample containing 0% DBP with increasing cure time. All peaks including 4530, 4925, 6080, 6570, and 6670 cm^{-1} exhibited near complete disappearance after 15 h of cure at 90 °C. There were additional negligible changes between 15 h and 3 days and between 3 days and 6 days, respectively. The elimination of the assigned peaks indicates complete extent of cure for the highest cross-link density (D230 / PPGDE640) elastomer with 0 % DBP within 6 days of cure and the resolution of IR spectroscopy.

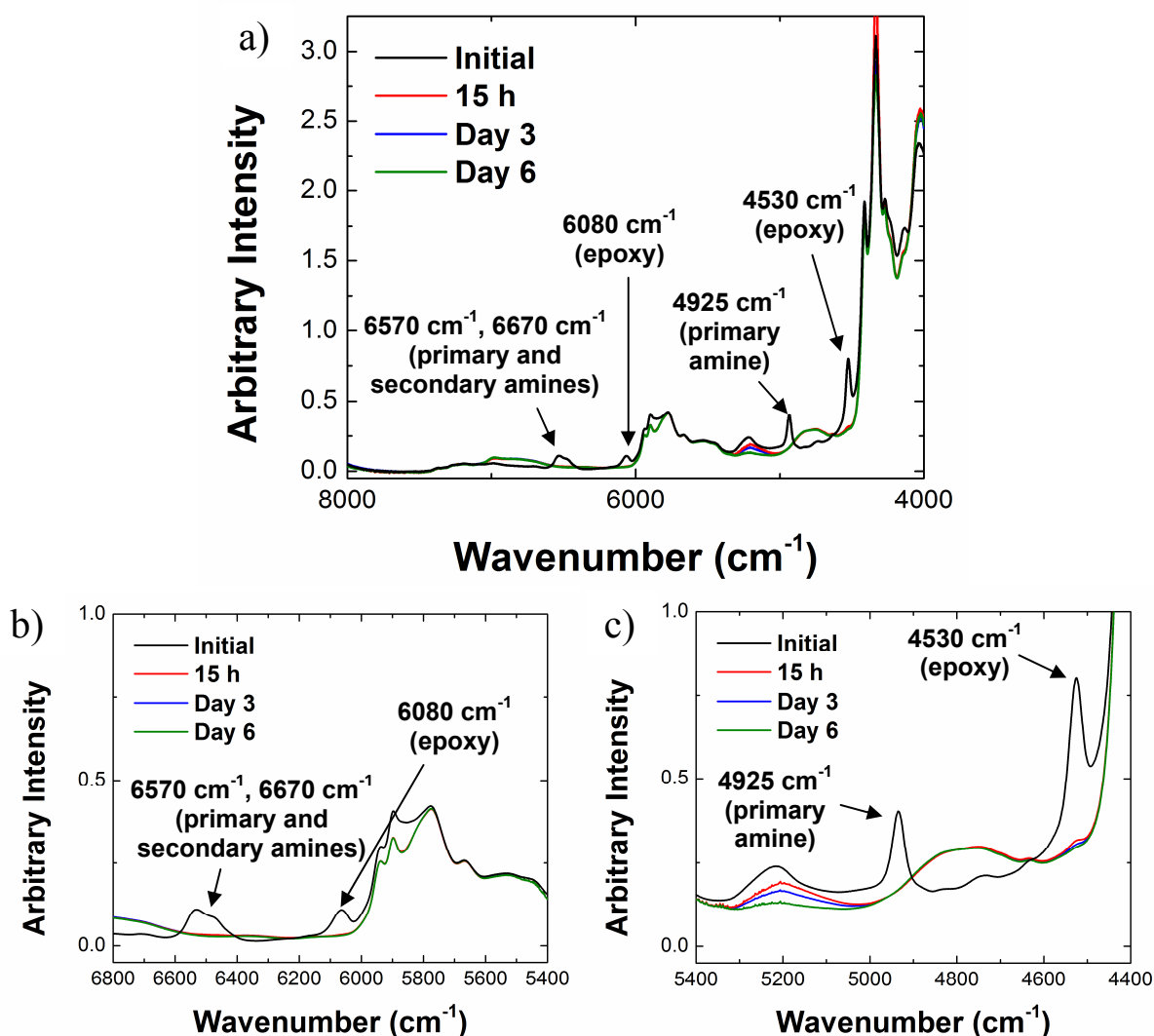


Figure S2: Near IR spectra of a D230 / PPGDE640 epoxy containing 0% DBP prior to curing and after, 15 h 3 days, and 6 days of cure at 90 °C in a range of a) 4000 to 8000 cm^{-1} and expanded regions of b) 5400 to 6800 cm^{-1} and c) 4400 to 5400 cm^{-1} , respectively.

NIR of D4000 w/ 0 % DBP

Similar data for D4000 / PPGDE 640 elastomer containing 0% DBP also demonstrates a complete cure within 6 days as determined by the complete disappearance of all of the relevant peaks (Figure S3).

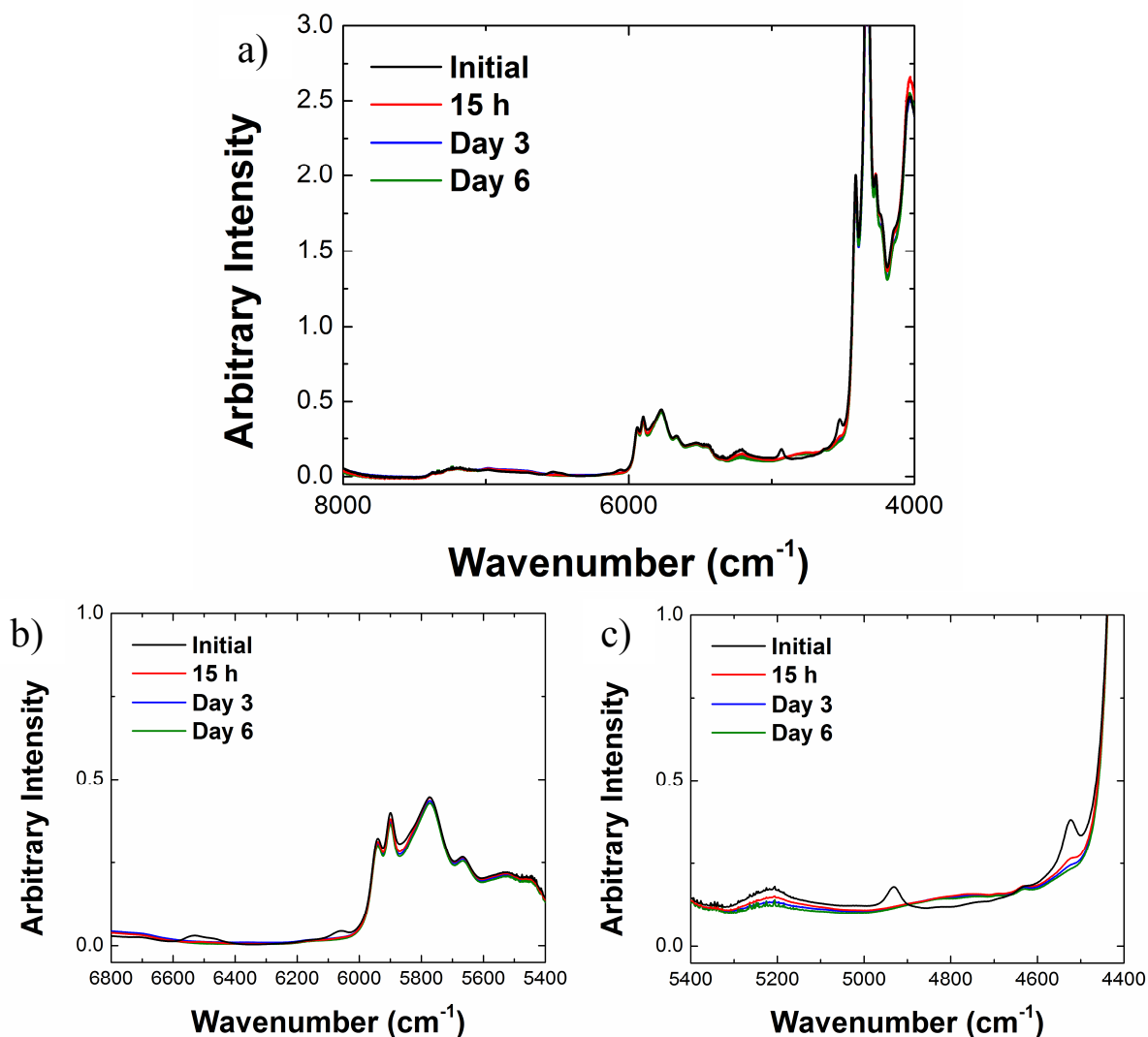


Figure S3: Near IR spectra of a D4000 / PPGDE640 epoxy containing 0% DBP prior to curing and after 15 h, 3 days, and 6 days of cure at 90 °C in a range of a) 4000 to 8000 cm⁻¹ and expanded regions of b) 5400 to 6800 cm⁻¹ and c) 4400 to 5400 cm⁻¹, respectively.

DBP Only

The low volatility solvent used in this study complicates the analysis because it contains a peak at 4530 cm^{-1} (Figure S4). As a result, the peak at epoxy peak at 4530 cm^{-1} will only be reduced to the baseline value of DBP at complete cure. To determine the extent of cure, the peak area ratio between the regions extending from 4745 cm^{-1} to 4585 cm^{-1} , predominantly attributed to DBP, and the region from 4543 to 4503 cm^{-1} , containing signal from both the DBP and epoxy functionalities, were measured after 6 days of cure. At complete cure of the epoxy-amine gels, the ratio between these two regions should be similar to the ratio observed in pure DBP.

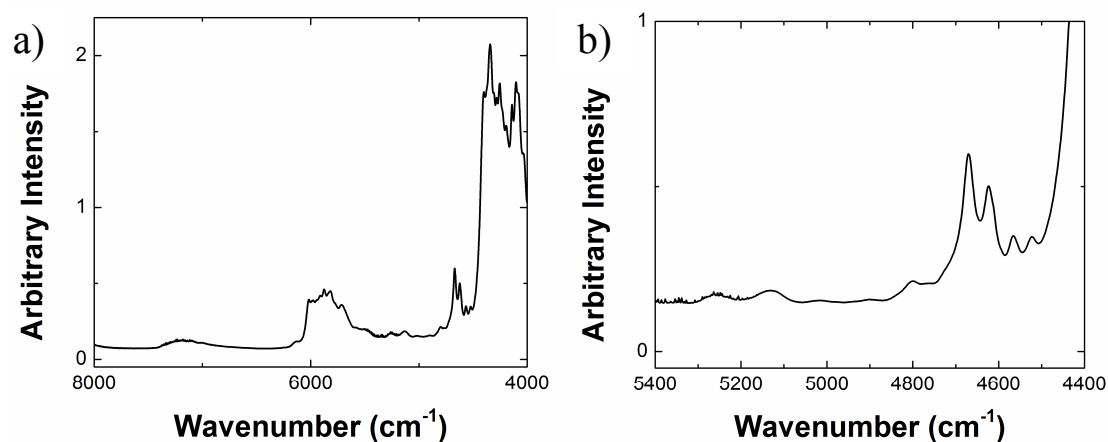


Figure S4: Near IR spectra of DBP in a range of a) 4000 to 8000 cm^{-1} and an expanded region of b) 4400 to 5400 cm^{-1} .

D230 w/ 60 % DBP

All of the relevant peaks were weaker consistent with dilution but, were still observable with the exception of the epoxy stretching peak at 6080 cm^{-1} that overlaps with the DBP spectra (Figure S5). Similar to the 0% DBP elastomers, all of the peaks exhibited near complete disappearance after 15 h cure at $90\text{ }^{\circ}\text{C}$ with additional negligible changes between 15 h and 3 days and between 3 days and 6 days, respectively. After 6 days, the peak ratios were consistent with those of pure DBP demonstrating complete cure.

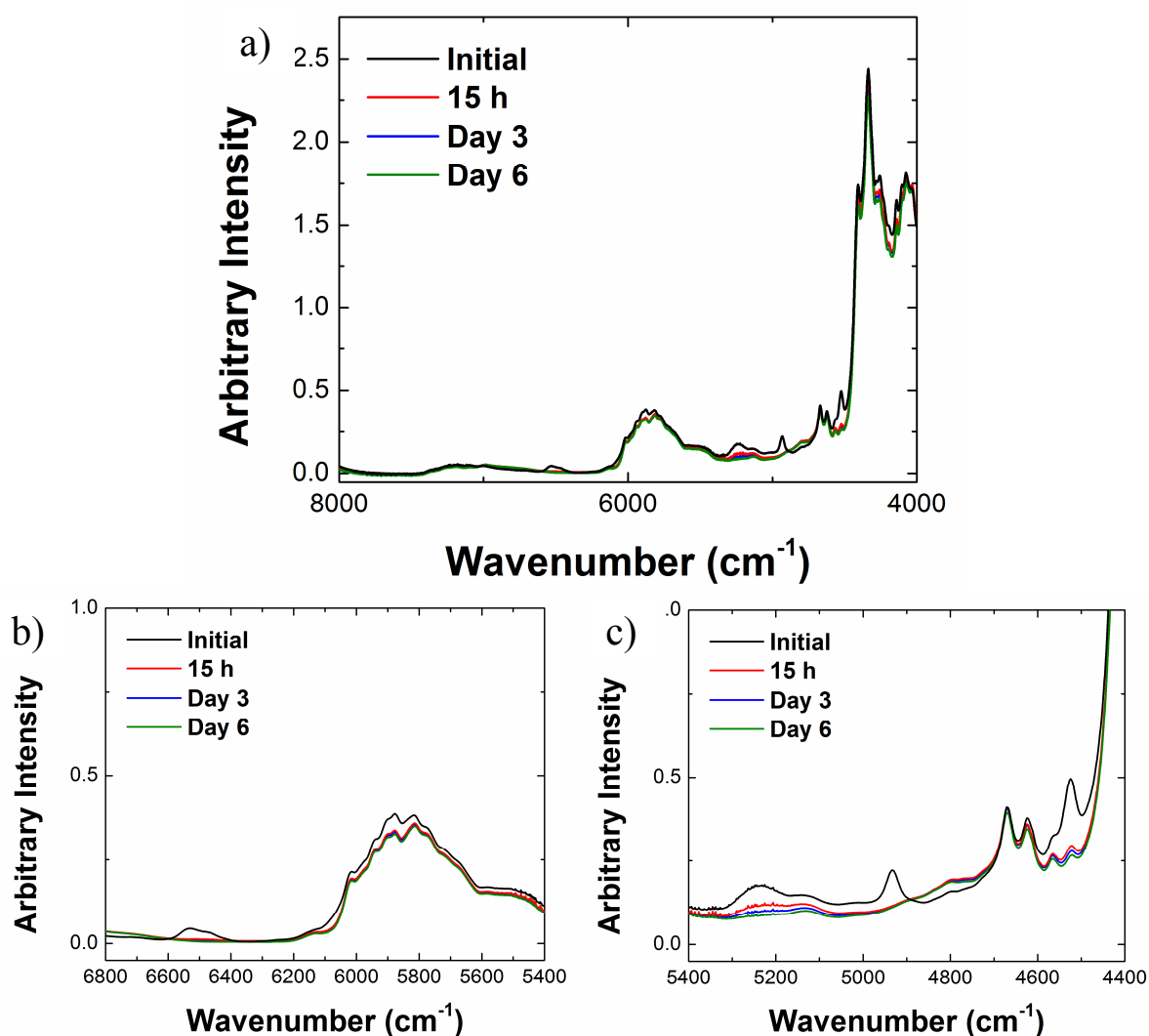


Figure S5: Near IR spectra of a D230 / PPGDE640 epoxy containing 60% prior to curing and after 15 h, 3 days, and 6 days of cure at $90\text{ }^{\circ}\text{C}$ in a range of a) $4000\text{ to }8000\text{ cm}^{-1}$ and expanded regions of b) $5400\text{ to }6800\text{ cm}^{-1}$ and c) $4400\text{ to }5400\text{ cm}^{-1}$, respectively.

D4000 w/ 60 % DBP

The D4000 / PPGDE640 sample containing 60% DBP exhibited similar behavior to the D230 sample containing 60% DBP (Figure S6). After 6 days of curing at 90 °C, the peak ratios were consistent with those of pure DBP demonstrating complete cure. An expanded region of 6700 to 6300 cm^{-1} demonstrates that the peaks at 6570 and 6670 cm^{-1} , corresponding to the primary and secondary amines, are also completely eliminated further verifying complete cure.

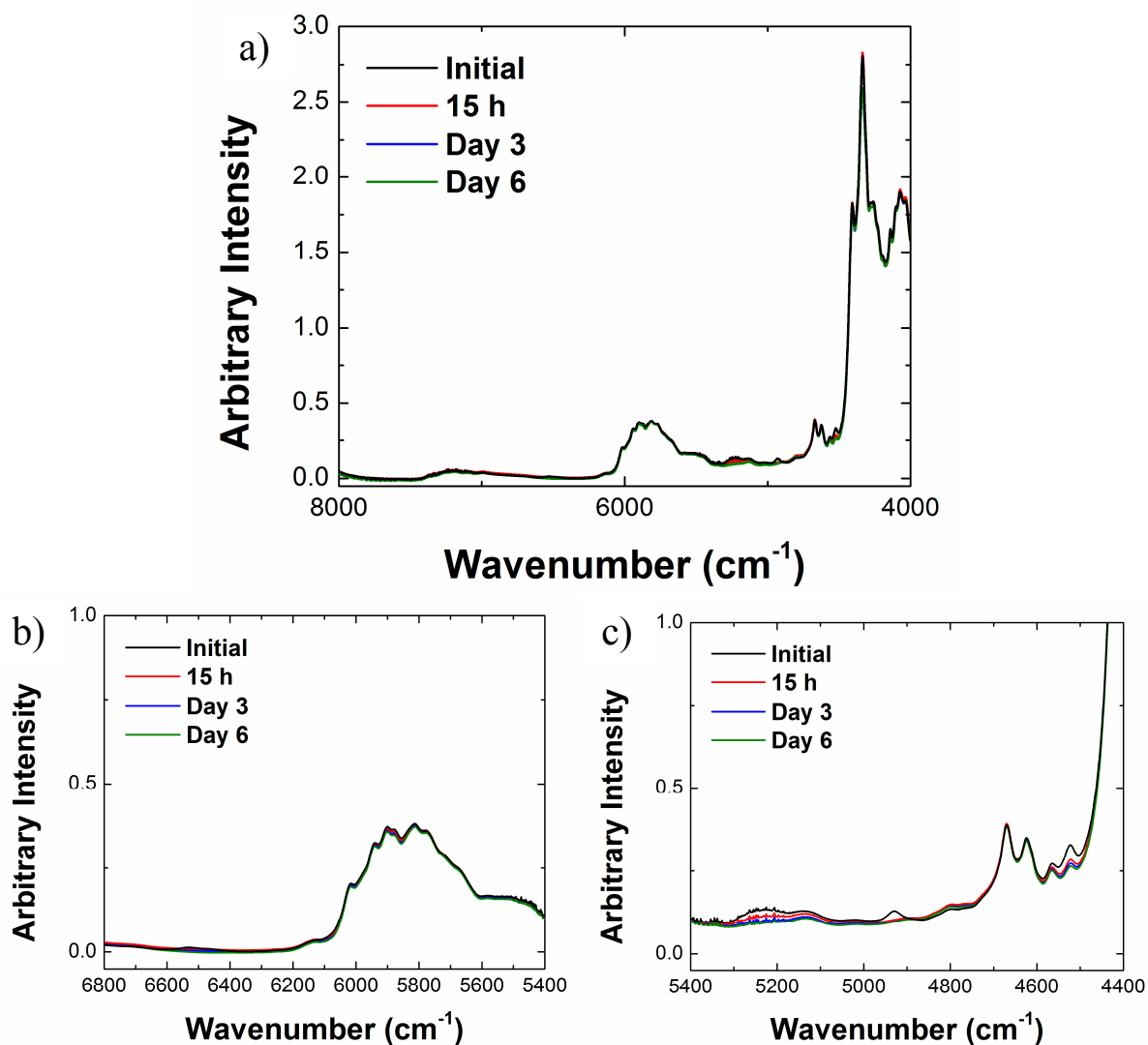


Figure S6: Near IR spectra of a D4000 / PPGDE640 epoxy containing 60% prior to curing and after 15 h, 3 days, and 6 days of cure at 90 °C in a range of a) 4000 to 8000 cm^{-1} and expanded regions of b) 5400 to 6800 cm^{-1} and c) 4400 to 5400 cm^{-1} , respectively.

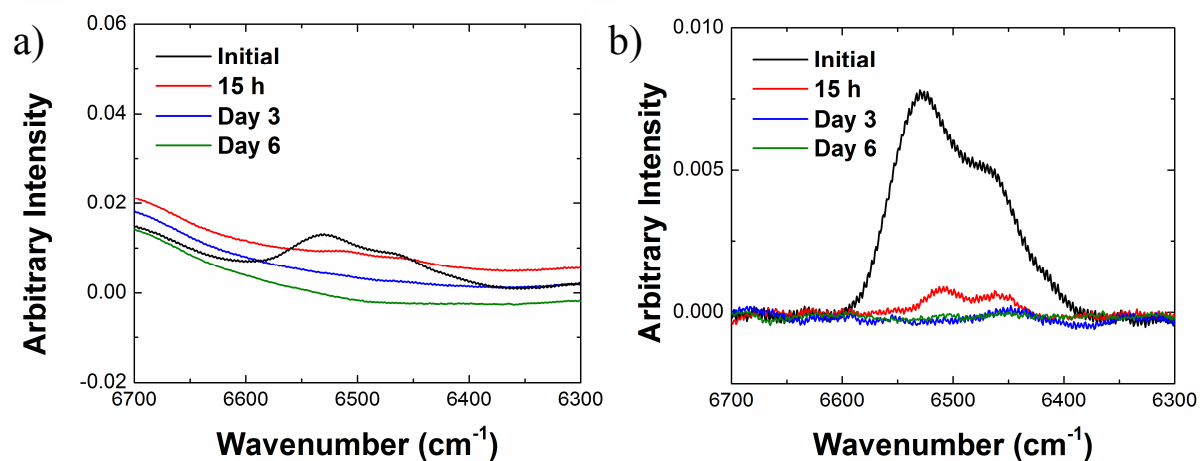


Figure S7: Near IR spectra of a D4000 / PPGDE640 epoxy containing 60% prior to curing and after 15 h, 3 days, and 6 days of cure at 90 °C in the range of 6700 to 6300 cm⁻¹ a) before and b) after baseline correction.

References

1. J. Mijovic and S. Andjelic, *Macromolecules*, 1995, **28**, 2787-2796.
2. V. I. Raman and G. R. Palmese, *Macromolecules*, 2005, **38**, 6923-6930.