MSE-6: Alkylborane Initiators for Ambient 3D Printing

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Problem Statement:

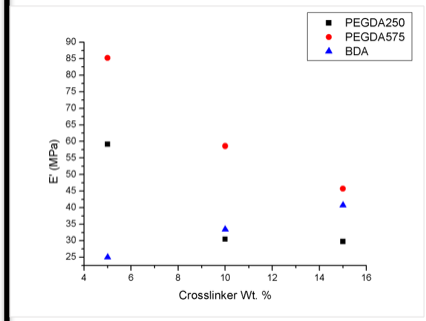
Is the alkylborane free radical mechanism a suitable for reactive 3D printing of samples at room temperature and ambient conditions?

Approach:

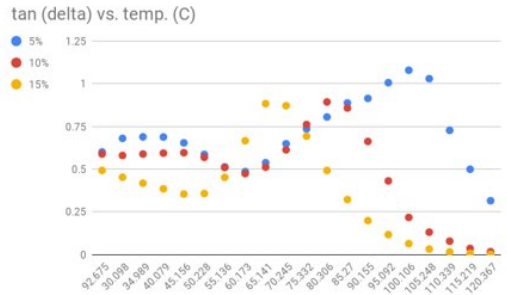
Samples synthesized and characterized based on initiator concentration and crosslinker concentration:

- Frequency sweeps to determine storage modulus.
- Nanoindentation to determine conversion rates across geometry.
- FTIR to determine conversion in different concentration samples.
- Temperature sweeps to determine variance in glass transition (T_g)

Results:



Frequency sweep results for PEGDA575, BDA, and PEGDA250 at 5, 10, and 15 wt.%



Temperature sweep results for PEGDA575 at 5, 10, and 15 wt.%

- Frequency sweeps showed decrease in E' at higher wt.% crosslinker, except with BDA, and decrease in E' with lower MW crosslinker.
- Temperature sweeps showed decrease in T_g at higher wt.% crosslinker.

Discussion & Conclusions:

- Consistently, rate of reaction was inversely proportional to strength:
  - Smaller crosslinkers at the same stoichiometry resulted in faster reactions and lower E'.
  - Higher concentrations of crosslinker resulted in faster reactions and lower E'.
- Glass transition temperature was higher for lower wt.% crosslinker, which did not correlate with research done on other free radical mechanisms

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