Reprocessable Thermoset Photopolymers in 3D Printing Application

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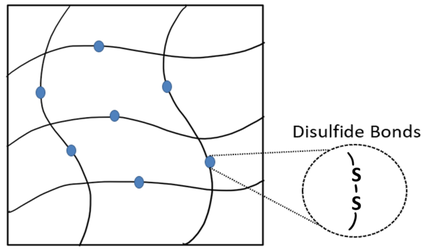
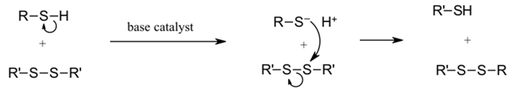
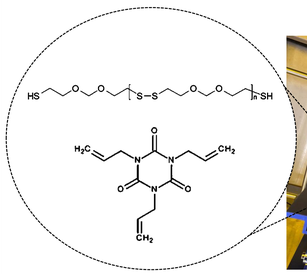
Introduction

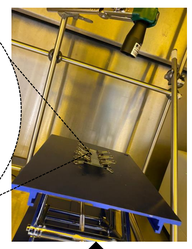
The monomers utilized are a multifunctional ene and an oligomeric thiol that are used to create a polymer network via step growth photoinduced radical-mediated thiol-ene "click" chemistry. The disulfide bonds are a dynamic covalent bonds that are capable of exchanging between several molecules by controlling the reaction condition which enables complete degradation of the polymer network into oligomers.[1]



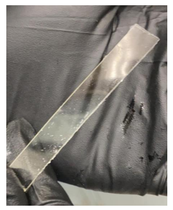


Methodology

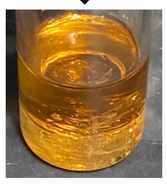




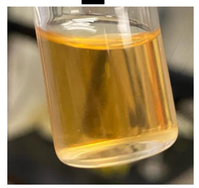
Photoinitiator
~4 W/cm^2
8.3 min



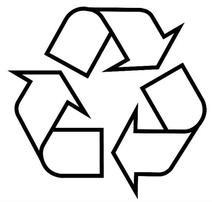
Excess Thiol



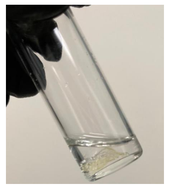
Base Catalyst
Triethanolamine (TEA)



Reprocessed

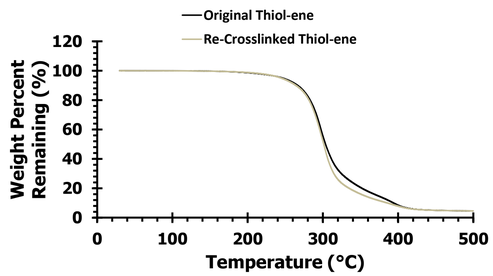


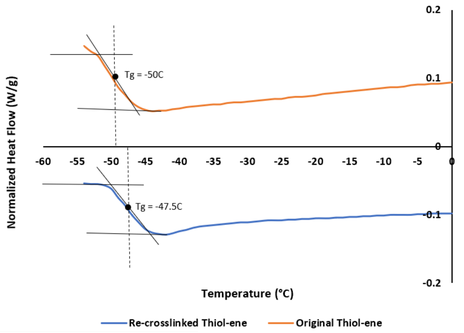
Results



$$G = \frac{m}{m_o} \times 100\%$$

m = mass of sample before extracting
m_o = mass of sample after extracting and drying

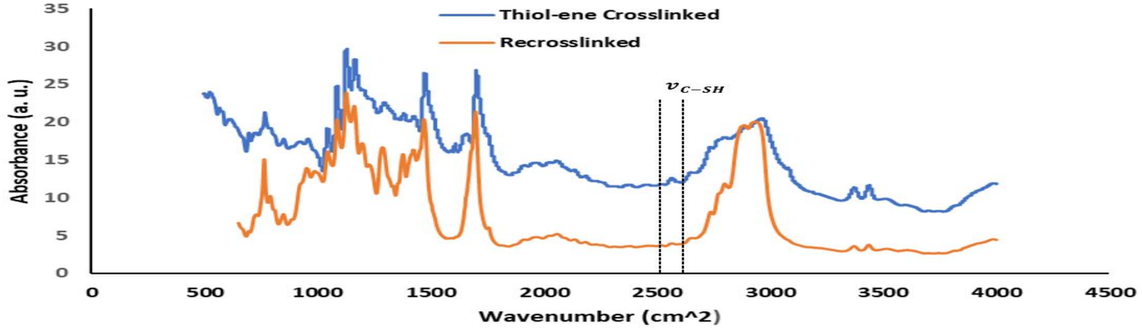




Sample	G %	T_d °C	T_g °C
Original	88.8	266.4	-50
Re-Crosslinked	85.8	264.2	-47.5

T_d= decomposition temperature at 10% weight loss

T_g= glass transition temperature



Conclusion

The recyclability of thermoset photopolymers is possible with dynamic covalent bonds.

Future Work

Multiple cycles of recycling is needed and GPC/SEC and FTIR analysis for MWD and thiol conversion.

References

[1] Zhang, W.; Jin, Y. In *Dynamic covalent chemistry principles, reactions, and applications*; Wiley: Hoboken, NJ, 2018; pp 376–377.

Acknowledgements

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