Project Title: Production of transient and recyclable low ceiling temperature polymer composites

Advisors: Evan Lloyd (PhD student, Chemical and Biomolecular Engineering), Prof. Scott White (Aerospace Engineering)

Project Description: Owing to their exceptional specific strength and stiffness, carbon fiber reinforced polymer composites (FRPCs) represent the next generation of materials for high-performance structural, aerospace, and automotive applications. However, their initial design principle (high strength, irreversible bonds) requires the use of energetically intensive and exceptionally harsh conditions during end-of-life disposal and recycling. In this project, we seek to design new, metastable polymer matrices capable of triggered transience at the end of their useful lifespan. The products of transience will be collected and recycled. The mild recycling conditions will alleviate the environmental and economic burden of disposing end-of-life FRPCs and will ensure against material property degradation during recycling.
As an undergraduate research assistant, your duties will include the fabrication of composite materials capable of the desired transient behavior. Fabrication will involve the synthesis of low ceiling temperature polymers, blending of the resulting polymers with various plasticizers, and infiltration of the blends in carbon fiber fabrics with traditional thermal processing techniques. The fiber volume fraction, void fraction, and mechanical properties of the composites will be evaluated with optical measurements and tensile testing. The final goal will be the optimization of blended formulations and thermal processing conditions to produce high-performance composite parts.

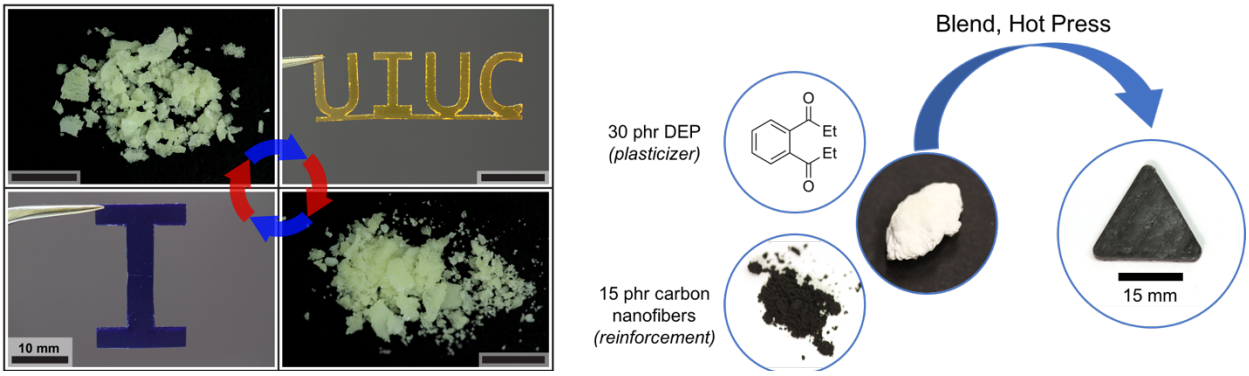

Figure 1. a) Thermally-mediated recycling of low ceiling temperature polymer films. Polymer films retain chemical and mechanical properties through multiple generations. b) Blending of low ceiling temperature composite films and subsequent thermal processing into a monolithic composite part with a thickness of 4 mm.

Student Background and Expected Research Activities:
We are seeking a highly motivated, enthusiastic student with interests in *polymer synthesis, composite manufacturing, and/or polymer characterization*. Laboratory experience in a research setting is desired, but not mandatory, as the student will be thoroughly trained in every aspect of the experiments in question. The student should be comfortable handling chemicals and operating testing equipment, be able to precisely follow safety and experimental protocols with great attention to detail, and exhibit strong communication skills.

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