DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

Department of Materials Science and Engineering,

PhD Thesis Defense

Wednesday August 10, 2022
1 pm – 3 pm

Zoom Link:
https://drexel.zoom.us/j/85933561503

Air-stable Alkylborane Initiation as a Toolkit to Drive Radical Reactions in a Diverse Set of Polymer Applications

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Abstract: In this PhD thesis, air-stable alkylborane-amine complexes are explored as initiators for complementary and novel radical-mediated polymerizations under convenient reaction conditions to assemble sophisticated polymer architectures. Rapid rates, high conversion, and structural control are afforded at ambient temperatures and in atmospheric conditions by employing alkylborane-amine complexes to drive ideal polymerizations. Free radicals are generated by employing deblocker agents, such as carboxylic acids and isocyanates to liberate the alkylborane from the complex, which then rapidly autoxidizes in the presence of oxygen to produce radicals necessary for polymerization. The first aim of this thesis demonstrates alkylborane initiated thiol-ene click chemistry as a method for rapid and *in situ* polymerization of highly loaded nanocomposites. The second aim introduces alkylborane initiation of thiol-yne click chemistry, exemplifying synthesis of reprocessable composites. The third aim illustrates durable adhesion to low surface energy polymers through alkylborane initiated graft polymerization to substrate surfaces, and the fourth aim employs alkylborane initiation in RAFT polymerization and elucidates mechanistic features of this approach. Through these aims, ideal radical polymerization mechanisms initiated through alkylborane-amine complexes are developed such that synthesis is oxygen tolerant and conducted at room temperature without the need for external initiation sources.