DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

Department of Materials Science and Engineering,

PhD Thesis Proposal

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Zoom Link:
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Employing Air-stable Alkylborane Initiators to Drive Radical Reaction 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 oxygen mediated and room temperature radical polymerization to assemble polymeric materials with macromolecular control. Rapid rates, high conversion, and structural control are afforded at ambient conditions by employing alkylborane-amine complexes which are liberated by deblocker agents such as carboxylic acids, and then rapidly autoxidize in the presence of oxygen, generating 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* initiation of highly loaded and thick nanocomposites. The second aim employs alkylborane initiation in RAFT polymerization and elucidates mechanistic features of this approach. The third aim illustrates durable adhesion to low-surface energy polymers through alkylborane initiation of graft polymers to substrate surfaces. The fourth aim introduces alkylborane initiation of thiol-yne click chemistry, demonstrating synthesis of re-healable nanocomposites. Through these aims, complementary radical chemistry 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.