DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

Department of Materials Science and Engineering,

Candidacy Exam

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Zoom: https://drexel.zoom.us/j/89374337069

Interfacial Improvements Within Cellulose Reinforced Polymer Composites

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Cellulose, the most abundant renewable material, has widely been used as reinforcement fiber in thermoplastics composites. While its use results in improved properties such as stiffness, its applications are limited by poor mechanical strength due to the lack of adhesion between the hydrophilic cellulose fiber and hydrophobic polymer matrix. Various modifications have been extensively researched and applied industrially to improve the adhesion such as fiber surface treatment, graft copolymerization, and interfacial linkages. When traditional polymers such as polyolefins are used as a matrix, these methods result in increased adhesion between fiber and matrix thus improving mechanical strength. Recent studies indicate that these methods are not as effective when biopolymers such as polyhydroxyalkanoates are substituted for traditional polymers. Instead, a novel approach of directly grafting biopolymers, poly(3-hydroxybutyrate) and poly(3-hydroxybutyrate-co-3-hydroxyvalerate), onto α-cellulose fibers via reactive extrusion with a small amount of peroxide is discussed. This method produces a fully biodegradable α-cellulose/PHB composite with an improved the fiber/matrix interface that exhibits mechanical strength superior to that of pure polyolefins without use of excess solvent or multiple synthesis steps.