Low cost, bio-renewable precursor fibers from lignin/polylactide (PLA) blends and graft copolymers for carbon fiber production

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Lignin, a highly aromatic biopolymer, which is extracted as a byproduct of wood pulping, has been investigated as a suitable precursor for carbon fibers. The present work demonstrates the feasibility of spinning modified lignin into robust fine lignin fibers by blending with poly(lactic acid) (PLA) biopolymer. Chemical modification of raw lignin was investigated to enhance the miscibility of lignin with PLA. Morphological investigations were conducted to study the influence of PLA concentration on the phase behavior of the blends and graft copolymers. The significance of phase miscibility in controlling the mechanical properties of raw fibers was studied. Lignin/PLA fibers were successfully stabilized and carbonized to produce carbon fibers with fine (~50 µm) cylindrical structure. Microstructural analysis of carbon fibers produced from these blends and copolymers revealed a composition dependent micro-porous structure inside the fine fibers.