

Lyocell-filaments from wood as precursor for carbon fibers

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Carbon materials have become vital components in our everyday life with wide-spread applications as lightweight and strong materials for energy-efficient mobility, green energy harvesting and storage, or filtration and purification of waste and fresh water. At present, commercial carbon materials are almost exclusively made from PAN- or pitch-based precursor fibers derived from non-renewable, fossil resources. However, the use of lignocellulosic materials as precursor substrates for carbon materials is experiencing a renaissance due to two main reasons: i) reducing the costs of the precursor fibers would open up new bulk markets such as carbon fiber reinforced composite materials to reduce the weight of vehicles; ii) fostering a bioeconomy based on sustainable and renewable raw material and reducing the dependency on petrochemical resources.

The currently commercialized process Ioncell® uses superbase-based ionic liquids (ILs) which are powerful solvents for a wide spectrum of polymeric and inorganic materials. These ILs provide solutions of lignocellulosic material with visco-elastic properties that are suitable for Lyocell-type dry-jet wet spinning of continuous filaments.

Herein, we report the dissolution of entire wood and subsequent dry-jet wet spinning into continuous filaments by means of the Ioncell® process. The Lyocell-type fibers are of high uniformity with a pronounced degree of orientation of the constituent biopolymers. This highly ordered structure is a distinct asset for the formation of an ordered carbon structure. The filaments were converted to carbon fibers through continuous carbonization in a carbon fiber line. Detailed analytical results will be presented.