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Regenerated cellulose fibers spun from 1-ethyl-3-methylimidazolium diethyl phosphate/dimethyl sulfoxide co-solvent systems

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Ionic Liquids (ILs) after reported by Swatloski, et al. in 2002 have drawn much attention as solvents for cellulose. However, the viscosity of cellulose/ILs solutions is relatively high, which requires longer solubilization time leading to high cost and negative effect on spinning. Some works about the addition of co-solvents into cellulose/ILs solution systems have been reported aiming to reduce the viscosity of the solutions. The addition of highly polar aprotic solvents such as dimethylformamide and Dimethyl Sulfoxide (DMSO) to ILs was found to possibly decrease the viscosity of cellulose solutions. Moreover, some reports showed that co-solvents could accelerate the dissolution of cellulose, which was particularly favorable for cellulose processing. However, to the best of our knowledge, there are few works concentrating on the final properties of cellulose regenerated cellulose fibers spun from ILs/co-solvents systems. Herein, in this study, regenerated cellulose fibers were prepared from co-solvent system consisting of a kind of imidazolium ILs, 1-Ethyl-3-Methylimidazolium Diethyl Phosphate (EMIMDEP) and DMSO via dry-jet wet spinning. The spinnability of spinning dopes, mechanical properties, structures and fibrillation behaviors of the regenerated fibers were investigated by comparing with pure EMIMDEP system. The results showed that the spinnability determined by the maximum winding speed reduced to less than half of that for cellulose/EMIMDEP solution after addition of 30 wt% DMSO. This may be derived from reduction of elongation viscosity, which leads to decrease in strength of spinning line under elongation flow. Moreover, regenerated cellulose fibers spun from EMIMDEP/DMSO 70/30 (wt/wt) showed lower tensile strength and Young's modulus, but superior fibrillation resistance. This was thought to be related to its low crystalline orientation and low degree of crystallinity.

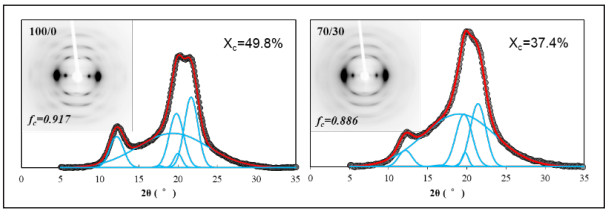

Figure-1: WAXD profiles with de-convoluted peaks for powdered regenerated cellulose fibers spun from EMIMDEP/DMSO solutions (100/0 (left image) and 70/30 wt/wt (right image)). X-ray fiber photographs of aligned fibers were also put in the figures.

Biography

Jiaping Zhang is a PhD student in Shinshu University, Japan. She studies mainly about the preparation of high performance regenerated cellulose fibers and ultrafine regenerated cellulose nonwoven fabrics in the Department of Materials Science and Engineering. She belongs to global leader program for fiber renaissance, which aims to cultivate young researchers with broader perspective, leadership and management skills.

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