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Electrospunquaternized polyvinyl alcohol nanofiberswith core-shell structure and their composite inalkaline fuel cell application

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Electrospunquaternized polyvinyl alcohol (Q-PVA) nanofibers were prepared and characterized. The as-spun nanofibers exhibited lower crystallinity than the pristine Q-PVA. The core of the fibers exhibited a more amorphous region and the outer shell contained more polymer crystals. The core-shell structure of the nanofibers provided unique ionic conduction functionality after doping with potassium hydroxide (KOH) solution. A composite consisting of 5.98% electrospun Q-PVA nanofiber mat and Q-PVA polymer matrix demonstrated enhanced ionic conductivity and suppressed methanol permeability when compared to a pristine dense Q-PVA film. Both the high conductivity and suppressed permeability were attributed to the quasi-coaxial structure of the electrospunnanofibers. The soft core of the fibers formed super ionic conductive paths, while the outer shell served as a hard sheath surrounding the amorphous core. This shell induced mass transfer resistance and created a tortuous fuel pathway that suppressed methanol permeation. Such Q-PVA composite is an effective solid electrolyte and validated using alkaline fuel cell. In a direct methanol alkaline fuel cell operated at 60°C, a peak power density of 54 mW cm^{-2} was obtained using the electrospun Q-PVA composite, a 12% increase compared to a cell employing a pristine Q-PVA film. These results demonstrate that super-conductive coaxial electrospunnanofiberscan be prepared through a single-opening spinneret and provide an elective approach for high-performance electrolyte fabrication.

Biography

Shingjiang Jessie Lue obtained BS and MS degrees from National Taiwan University, and PhD degree of Biotechnology Engineering from University of Missouri-Columbia, USA, in 1990. She joined Chang Gung University in 1996 and was promoted to a full Professor in 2007. She is now the department chair of Department of Chemical and Materials Engineering at CGU. Her research interest focuses on the development of high-performance materials for separation, energy, and biotechnology applications. She has published nearly 65 SCI papers and 2 book chapters, given 140 conference presentations, and applied 2 patents.

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