Effect of nanofiber specific surface area on ionic conductivity of electrospun poly(acrylonitrile-co-methyl acrylate) – Electrolyte membranes

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Electrospinning has been recognized as an efficient technique for the fabrication of polymer nanofibers. In this paper, we present a study of electrospun poly(acrylonitrile-co-methyl acrylate) – based gel electrolytes plasticized from a mixture of diethyl carbonate (DEC) / dimethyl carbonate (DMC) and lithium perchlorate (LiClO4) as electrolyte. We have used central composite design and response surface methodology to understand the relation between ionic conductivity and nanofibers specific surface area. Membranes show high initial electrolyte uptake and high retain (final uptake) due to their unique specific surface area. Plasticized polymer electrolytes encapsulate a large amount of liquid electrolytes in the nanoporous structure of the polymer host. They show a good ionic conductivity of above 1 mS/cm at room temperature and a high electrochemical stability. An increasing of 1.35 times in specific surface area (e.g. lower average fiber diameter) results in more initial and final electrolyte uptake and results in 1.5 times ion conductivity.