Surface-Initiated Atom Transfer Radical Polymerization from Electrospun Mats: An Alternative to Nafion - DTU Orbit (27/09/2019)

Proton exchange membranes for fuel cell applications are synthesized by surface-initiated (SI) atom transfer radical polymerization (ATRP). Poly(vinylidene fluoride-co-chlorotrifluoroethylene) is electrospun into 50 μm thick mat, which is then employed as multifunctional initiator for copper-mediated SI ATRP of 4-styrene sulfonic acid sodium salt. Fine-tuning of the ATRP conditions allows adjustment of the membrane’s ion exchange capacity by varying the loading of the grafted ionomer. Structure and composition of the membranes are investigated by spectroscopic means and thermogravimetric analysis, respectively. The membrane morphology is probed by scanning electron microscopy. A membrane with proton conductivity as high as 100 mS cm\(^{-1}\) is obtained. Long-term durability study in direct methanol fuel cells is conducted for over 1500 h demonstrating the viability of this novel facile approach.

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Contributors: Javakhishvili, I., Dimitrov, I., Tynelius, O., Hales, J. H., Jankova Atanasova, K., Hvilsted, S.
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