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## Fully Sulfonated Graft Copolymer Blends – a Structure-Property Relationship Study

Mads M. Nielsen<sup>1</sup>, Ami C. C. Yang<sup>2</sup>, Katja Jankova<sup>1</sup>, Søren Hvilsted<sup>1</sup> and Steven Holdcroft<sup>2</sup>

<sup>1</sup>Department of Chemical and Biochemical Engineering, Danish Polymer Centre, Technical University of Denmark, DTU, DK-2800 Kgs. Lyngby, Denmark

<sup>2</sup>Department of Chemistry, Simon Fraser University, Burnaby, BC, V5A 1S6, Canada  
[mon@kt.dtu.dk](mailto:mon@kt.dtu.dk)

PerFluoroSulfonic Acids (PFSA) currently predominate as commercial state-of-the-art low temperature Proton Exchange Membranes (PEM), yet they suffer from especially high cost. Hence research to find alternatives is ongoing as large-scale commercialization of hydrogen powered PEM fuel cell cars in 2015 is approaching [1]. The current study is a continuation of the previously presented work by Holdcroft et al. [2 – 3]. Post-sulfonated (s) poly(vinylidene fluoride-co-chlorotrifluoroethylene)-g-polystyrene (P(VDF-co-CTFE)-g-sPS) at three different graft lengths are blended with PVDF to contain sPS volume fractions similar to that of a reference P(VDF-co-CTFE)-g-sPS with a different graft density and graft length. Proton conductivities are measured at 55-95% Relative Humidity (RH) and 25-80 °C, and water uptake is followed by dynamic vapor sorption. P(VDF-co-CTFE)-g-sPS show stronger dependence on both RH and temperature than benchmark PFSA Nafion<sup>®</sup>, with superior conductivities by up to a factor of two at 95% RH.

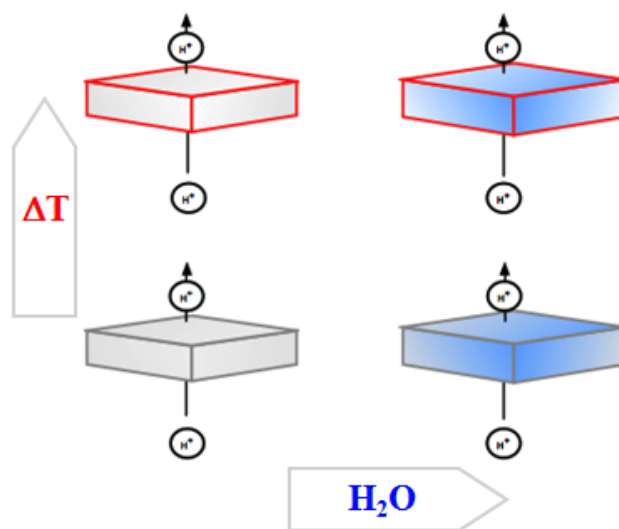


Figure 1. Proton conductivity is measured at various relative humidities and temperatures.

### References

- [1] Various authors, The Fuel Cell Today Industry Review 2011, [www.fuelcelltoday.com](http://www.fuelcelltoday.com), 16.04.12
- [2] Tsang, E. M. W.; Zhang, Z.; Shi, Z.; Soboleva, T.; Holdcroft, S. *J. Am. Chem. Soc.* **2007**, 129, 15106-15107
- [3] Tsang, E. M. W.; Zhang, Z.; Yang, A. C. C.; Shi, Z.; Peckham, T. J.; Narimani, R.; Frisken, B. J.; Holdcroft, S. *Macromolecules* **2009**, 42, 9467-9480.