**SPVdF-HFP/SGO Nanohybrid Proton Exchange Membrane for the Applications of Direct Methanol Fuel Cells**

**Supporting Information**



**Figure S1.** 1H NMR spectrum of SPVdF-HFP.

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Figure S2. FT-IR spectra of membranes.

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 **Figure S3.** XRD patterns of membranes.

**Table.S1.** Comparative table of various reported in DMFCs.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Membrane** | **Proton conductivity (mS/cm)****[RHa (%);Temb (º C)]** | **Methanol permeability (cm2/s)** | **Selectivity****(S s/cm3)** | **Oxidative stability****(%)** | **References** |
| Nafion 212 | 24[100;RT**c**] | 5.5×10-6 | - | - | 45 |
| Nafion 117 | 30.2[100;RT**c**] | 1.22×10-6 | 2.47×104 | - | 30 |
| SPVdF-co-HFP**d** coated Nafion | 30.1[100;RT**c**] | 9.71×10-7 | 3.099×104 | - | 30 |
| SPVdF-HFP**d** /PES**e**10 | 3[100;RT**c**] | 1.22×10-7 | 2.33×104 | 99.2 | 46 |
| SPVdF-HFP**d** /SGO**f**-7 | 5.52[100;30] | 1.846×10-7 | 2.990×104 | 89.5 | 16 |
| SPVHP**g**70 | 5.12[100;20] | 1.29×10-8 | 3.97×105 | - | 47 |
| SPVdF-co-HFP**d** /SPAni**h** | 4.54[100;20] | 1.44×10-7 | 3.15×104 | - | 48 |
| SPVdF-HFP**d** /Nafion/Al2O3**i** | 35.7[100;20] | 6.41×10-7 | 5.56×104 | - | 49 |
| SPVdF-HFP**d** /SGO**f** | 7.8[100;70] | 2.567×10-7 | 3.038×104 | 87 | In this work |

**a**Relative humidity

**b**Temperature

**c**Room temperature

**d**Sulfonated poly (vinylidenefluoride-co-hexafluoropropylene)

**e**Poly (ether sulfone)

**f**Sulfonated graphene oxide

**g**SPVdF-co-HFP/PAni NF membrane (i.e. PAniNF treated with SDS for 70 min).

**h**Sulfonated polyaniline

**i**Aluminium oxide