Supplementary information

Synthesis and alkaline stability of Aquivion-based perfluorinated anion exchange membranes

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1. Supplementary experimental methods

1.1. Preparation of NiFe catalyst-coated Ni foam electrodes for water electrolysis test

A nickel foam sheet (4 cm × 2 cm × 1 mm) was cleaned in ethanol for 15 min in an ultrasonic bath, followed by rinsing three times with deionized water. Subsequently, $Ni(NO_3)_2·6H_2O$ (0.8 mmol), $Fe(NO_3)_3·9H_2O$ (0.8 mmol), and urea (2 mmol) were dissolved in 40 mL of ethanol under stirring for 30 min. The pretreated Ni foam and the resulting solution were then transferred to a 250 mL Teflon-lined autoclave and subjected to a solvothermal reaction at 120°C for 12 h. After cooling to room temperature, a NiFe catalyst layer was deposited on the Ni foam surface. The resulting NiFe catalyst-coated Ni foam was washed with ethanol and deionized water using bath sonication for 5 min, followed by drying at 65°C for 12 h before use.

1.2 Preparation of gas diffusion electrodes for fuel cell test

A catalyst ink was prepared by mixing 400 mg of deionized water, 16 mg of carbon black-supported platinum catalyst (20 wt% Pt on Vulcan XC72), 80 mg of ionomer solution (Sustainion® XB-7 alkaline ionomer, 5 wt% in ethanol, Dioxide Materials), and 400 mg of ethanol. The mixture was first homogenized by bath sonication for 15 min, followed by probe sonication for 5 min. The resulting catalyst ink was then drop-coated onto a 2 cm × 2 cm piece of carbon paper (GDL210S, CeTech) placed on a hotplate maintained at 85 °C to prepare a gas diffusion electrode (GDE), achieving a platinum loading of 0.8 mg/cm^2.

2. Figures

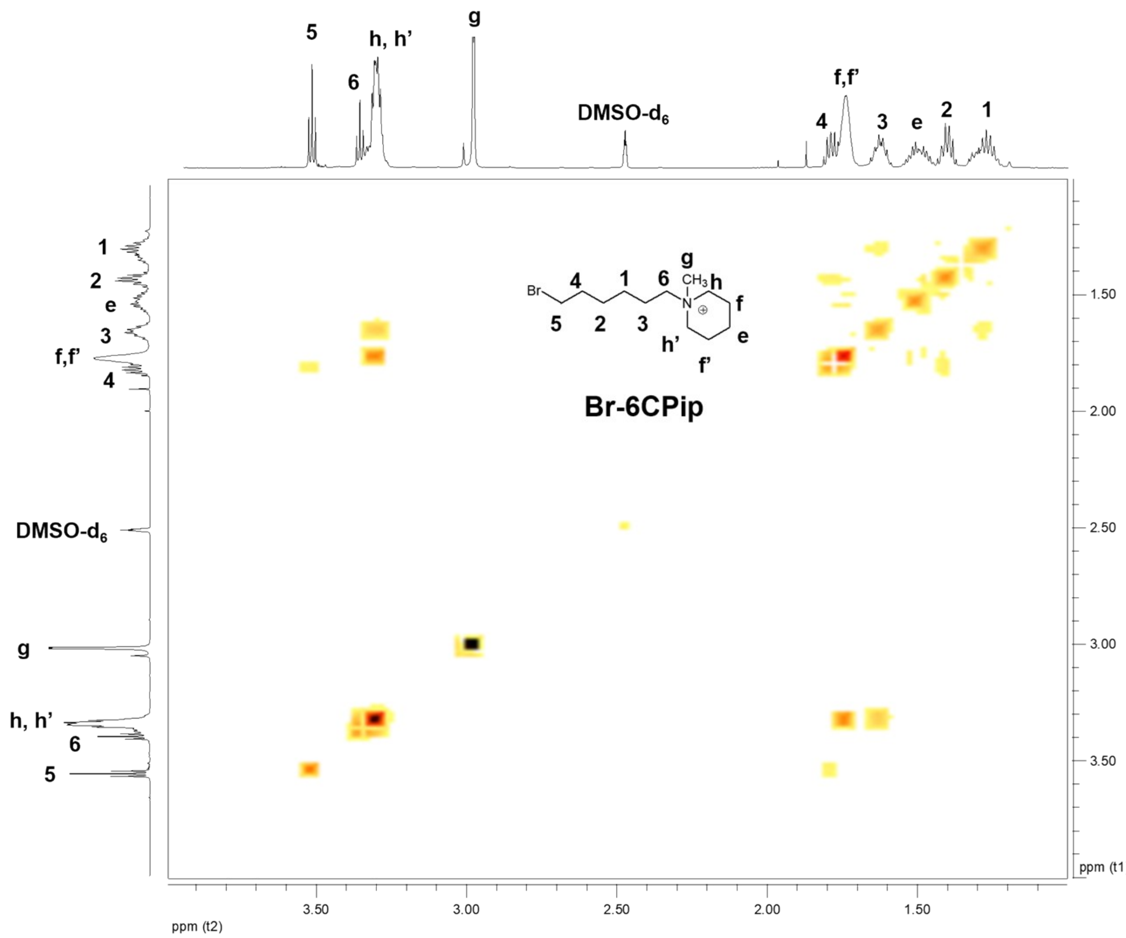

Fig. S1 ^{1}H–^{1}H COSY spectrum of Br-6CPip.

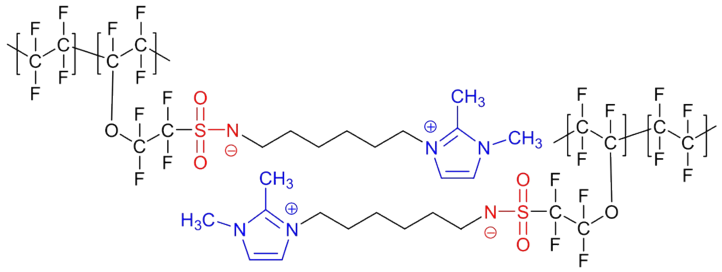

Fig. S2 Illustration of the possible zwitterionic behavior of the sulfonamide group interacting with the cationic end groups in Aquivion-based perfluorinated AEMs, exemplified by Aquivion-SO_2NH-6CIm.

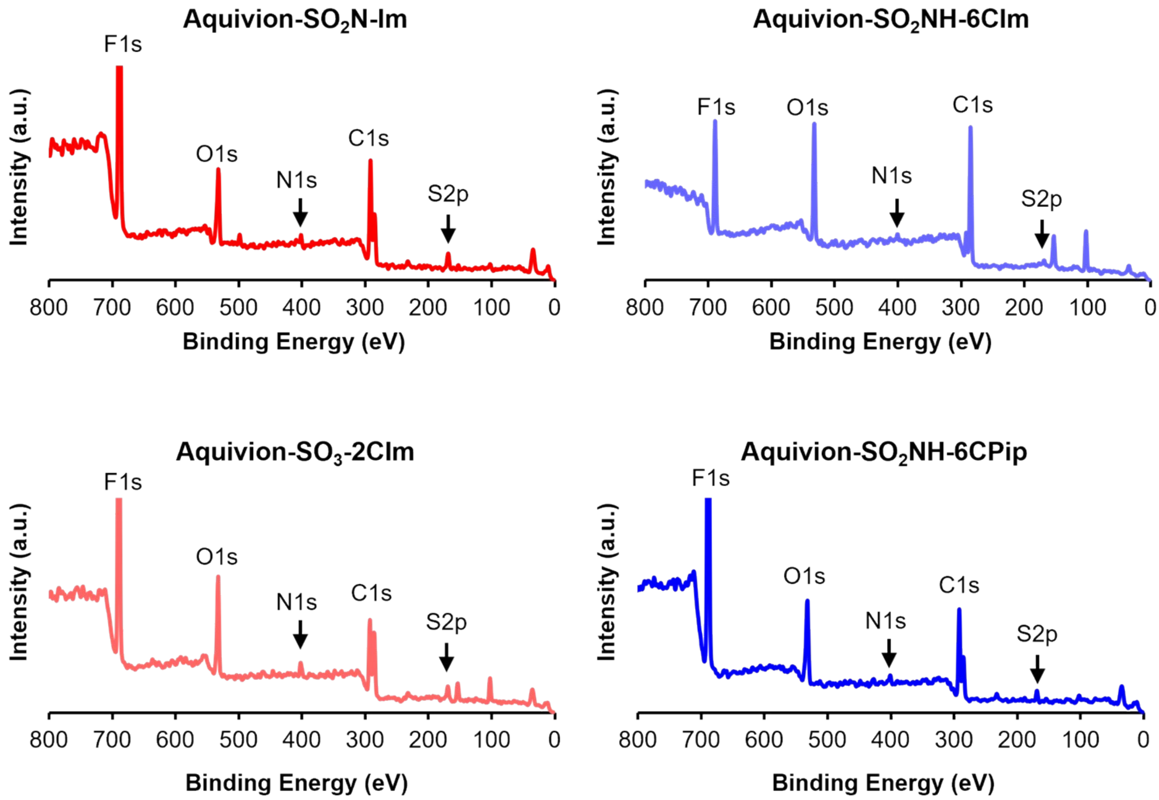

Fig. S3. Full XPS spectra of the Aquivion-based perfluorinated AEMs.

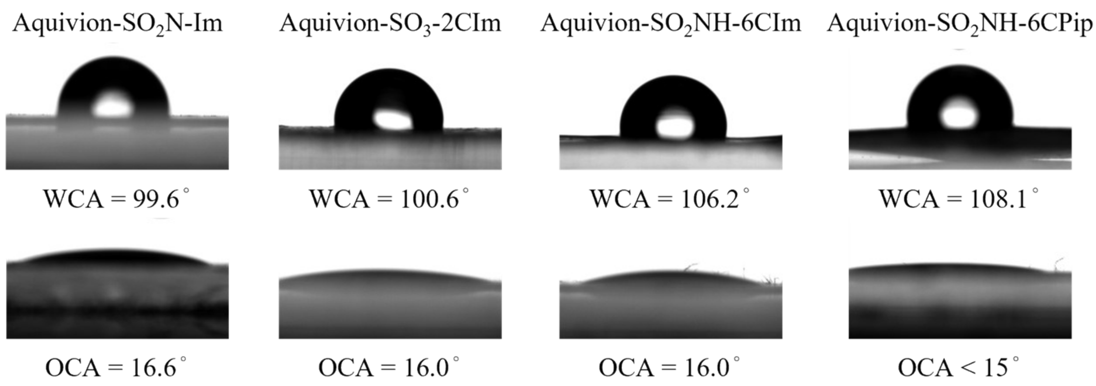

Fig. S4. Water contact angles (WCA) and oil contact angles (OCA) of Aquivion-based perfluorinated AEM membrane surfaces, measured using deionized water and dodecane as probe liquids.