Functional G-Quartet Macroscopic Membrane Films**

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Materials and methods: Guanosine, 1, 2-formylphenylboronic acid, 2 and bis(3-aminopropyl)-polytetrahydrofuran, 3 (Mₙ ca. 1100 g mol⁻¹) were purchased from Aldrich and used as received. All other reagents were obtained from commercial suppliers and used without further purification. All organic solutions were routinely dried by using sodium sulfate (Na₂SO₄). ¹H and ¹³C NMR spectra were recorded on an ARX 300 MHz Bruker spectrometer in CD₃OD and d₆-DMSO with the use of the residual solvent peak as reference. Solid state ¹¹B MAS NMR was performed on a Brucker ASX400 spectrometer. X-ray powder diffraction measurements were performed with Cu-Kα radiation at 20°C using a Philips X’Pert Diffractometer equipped with a Xcelerator detector. SEM images were obtained with a Hitachi S-4500 apparatus, under a tension of 0.5-30 kV.

Bis(3-propyl-(2-iminomethyl)-phenylboronicacid)-polytetrahydrofuran. 4:

2-formylphenyl boronic acid (0.6 g, 4.00 mmol) was dissolved in chloroform (50 ml) and bis(3-aminopropyl)-terminated polytetrahydrofuran, (Mₙ ca. 1100 g mol⁻¹) (2.2 g, 2.00 mmol) was added. The reaction was stirred for overnight at reflux. The mixture was concentrated then methanol and water were added successively. The organic phase was separated, dried with anhydrous sodium sulfate and evaporated in a rotary evaporate to give yellow oil 1 (2.73 g, 2.00 mmol, 100%). ¹H NMR (300 MHz, CD₃OD): δ 8.73 (2H, s, H₅), 7.66 (2H, d, H₄), 7.53 (2H, s, H₃), 7.66 (2H, d, H₄), 7.53

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(4H, m, H₂, H₃), 7.38 (2H, m, H₁), 3.75 (4H, m, H₆), 3.59 (4H, m, H₈), 3.46 (48H, s, H₉), 2.13 
(4H, m, H₇), 1.64 (48H, H₁₀). 13C NMR (300 MHz, CD₃OD): δ 168.54, 137.57, 131.84, 
129.11, 127.01, 125.96, 77.61, 69.77, 56.42, 27.59, 25.69; ESI-MS: 685.03 [4+2H⁺]²⁺ and 
1199.74 [4+H⁺]; IR (film, ATR Diamant Golden Gate) 1640, 1300 cm⁻¹.

Figure 1S. ¹H NMR (300MHz, CD₃OD) and ¹³C NMR(75 MHz, CD₃OD) of compound 4
General procedures for synthesis of membrane materials:

**Membrane M_{G4}:** In typical experiment, at a suspension of guanosine (0.125 g, 0.44 mmol) in water (100 ml) was added potassium chloride (0.0082 g, 0.11 mmol). The mixture was stirred at 120°C during one hour, and then the solvent was removed. This powder was solubilized in mixture of ethanol-dimethylsulfoxide (34-9 ml) and compound 4 (0.3 g, 0.44 mmol) was added. The reaction was stirred at 110°C during one night. Ethanol was evaporated; the mixture in dimethylsulfoxide was cast in Teflon-brand plate (42 X 25 mm, 25 ml, Bioblock) and placed in oven at 100-110°C during 2-3 days to obtain the film by solvent evaporation.

**Membrane M_{0}:** Guanosine (0.125 g, 0.44 mmol) and compound 4 (0.3 g, 0.44 mmol) were dissolved in mixture of ethanol-dimethylsulfoxide (34-9 ml). The reaction was stirred at 110°C during one night. Ethanol was evaporated; the mixture in dimethylsulfoxide was cast in Teflon-brand plate (42 X 25 mm, 25 ml, Bioblock) and placed in oven at 100-110°C during 2-3 days to obtain the film by solvent evaporation.

*Figure 2S.* FTIR spectra of Guanosine, 2 iminoboronate macromonomer, 4 and M_{0} and M_{G4} membrane materials.
Figure 3S. $^{11}$B MAS NMR spectra at solid state of compounds: a) 4, (b) $M_0$ and $M_{G4}$.

**AC impedance spectroscopy measurements** were performed at room temperature with ambient relative humidity in the frequency range of 100 KHz to 0.1 Hz using a Solartron 1260 frequency response analyzer coupled with a dielectric interface (Solartron 1296). The amplitude of the applied voltage signal was 10mV and the spectra were analyzed using Zview® software. The dry membranes were placed in a test cell and were sandwiched between two Hg/Pt electrodes. The specific conductivity $\sigma$ (S.cm$^{-1}$) of the membrane in the transverse direction was calculated from the impedance data, using the relation $\sigma = \varepsilon/R*S$. $\varepsilon$ represents the thickness (cm) and $S$ is the exposed area of the sample (2.5 cm$^2$) with the electrodes; the resistance $R$ ($\Omega$) was derived from the high frequency intercept with the real axis on Nyquist impedance plot (corresponding to the phase angle closest to zero in the complex diagram). In the spectra, (Figure 5S) two different regions can be observed. They consist of a semicircle part corresponding to the capacitive response of the membrane and the second linear part is attributed to the bulk conductivity. The conductivity values for $M_0$ and
\( M_{G4} \) membrane materials were quite low compared to the classical reported values for a reference proton exchange membrane (\( \sigma_{\text{Nafion}} = 10^{-1}/10^{-2} \text{ S.cm}^{-1} \)).

\[ a) \]

**Figure 4S:** Complex plane plots obtained over the frequency range of 100 KHz to 0.1 Hz for a) untemplated \( M_0 \) and \( K^+ \) templated \( M_{G4} \) membrane materials at room temperature.

**Membrane transport experiments:** were performed with a bi-compartmental diffusion cell device, magnetically stirred at room temperature. It consists of two PTFE cell device separated by the solid membrane oriented with the active dense film to the feed phase (Figure 6S). Nitrogen permeation measurements were performed to ensure that they were dense and defect free. The feed phase was 50ml of aqueous equimolar solution of \( 10^{-1}\text{M NaCl/10}^{-1}\text{M KCl} \). The membrane consisted of self-supported membrane dense material \( M_{G4} (S=5.32 \text{ cm}^2) \) while the receiving phase consisted of 50 ml of deionized water. The \( \text{Na}^+ \) and \( \text{K}^+ \) concentrations were monitored at different time intervals using the atomic absorption spectrophotometry. The diffusion coefficients \( D \), have been determined from experimental concentration versus time profiles using the solution-diffusion model.\[^{[15]}\]
Figure 5S. Experimental device used in diffusion membrane transport experiments