

Supplementary Information

Selective Trans-membrane Transport of Alkali and Alkaline Earth Cations through Graphene Oxide Membranes Based on Cation- π Interactions

Pengzhan Sun¹, Feng Zheng¹, Miao Zhu^{1,2}, Zhigong Song^{2,3}, Kunlin Wang¹, Minlin Zhong¹,
Dehai Wu⁴, Zhiping Xu^{2,3}, Hongwei Zhu^{1,2}

¹School of Materials Science and Engineering, Key Laboratory of Materials Processing Technology, Tsinghua University, Beijing 100084, P. R. China

²Center for Nano and Micro Mechanics, Tsinghua University, Beijing 100084, P. R. China

³Department of Engineering Mechanics, Tsinghua University, Beijing 100084, P. R. China

⁴Department of Mechanical Engineering, Tsinghua University, Beijing 100084, P. R. P. R. China

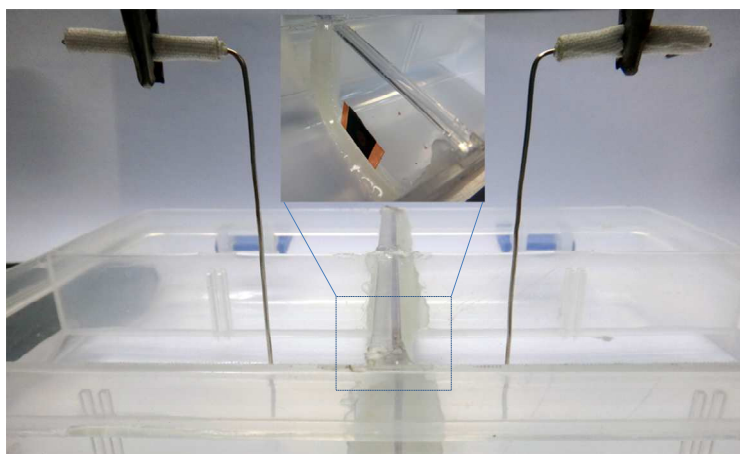


Figure S1. Homemade permeability apparatus for ion trans-membrane transport experiments.

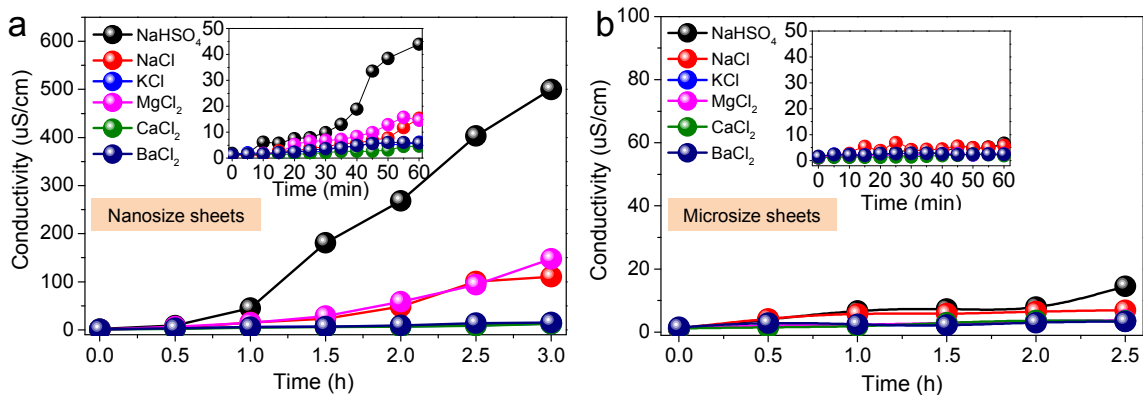


Figure S2. Conductivities of the filtrates of studied cations through G-O membranes prepared by (a) nanosize and (b) microsize G-O sheets. Insets show the initial stages (0~60min) of the penetrations.

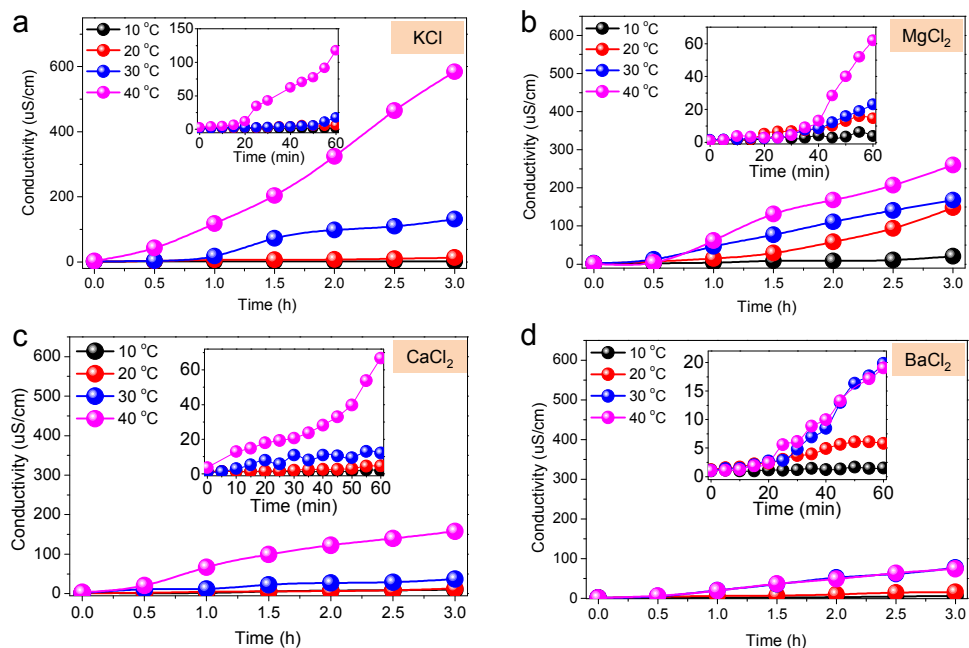


Figure S3. Temperature dependent penetrations of heavy alkali and alkaline-earth metal cations (10-40°C). (a) KCl, (b) MgCl₂, (c) CaCl₂, (d) BaCl₂. Insets show the initial stages (0~60min) of the penetrations.

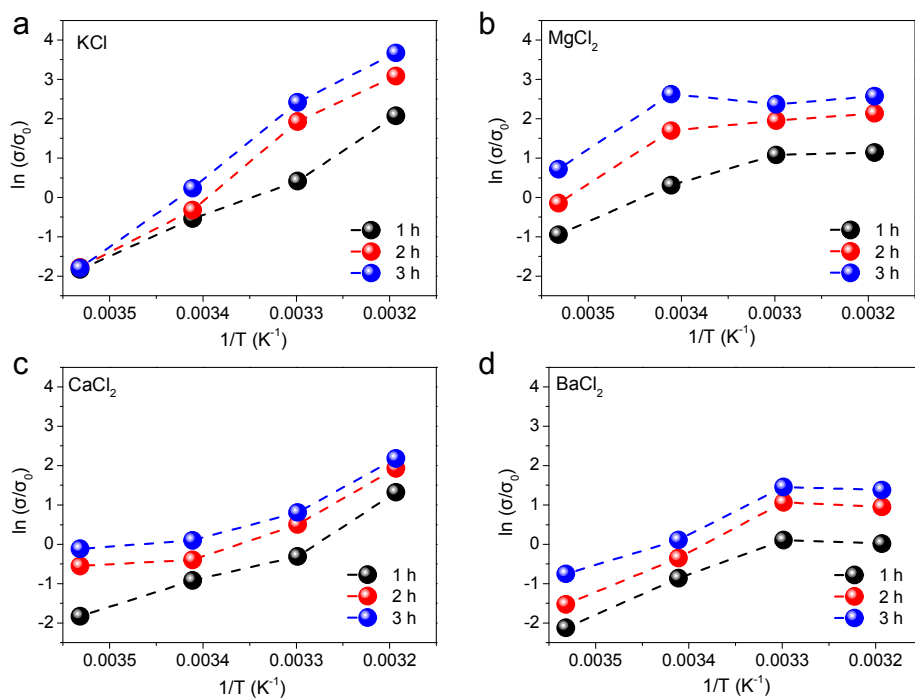
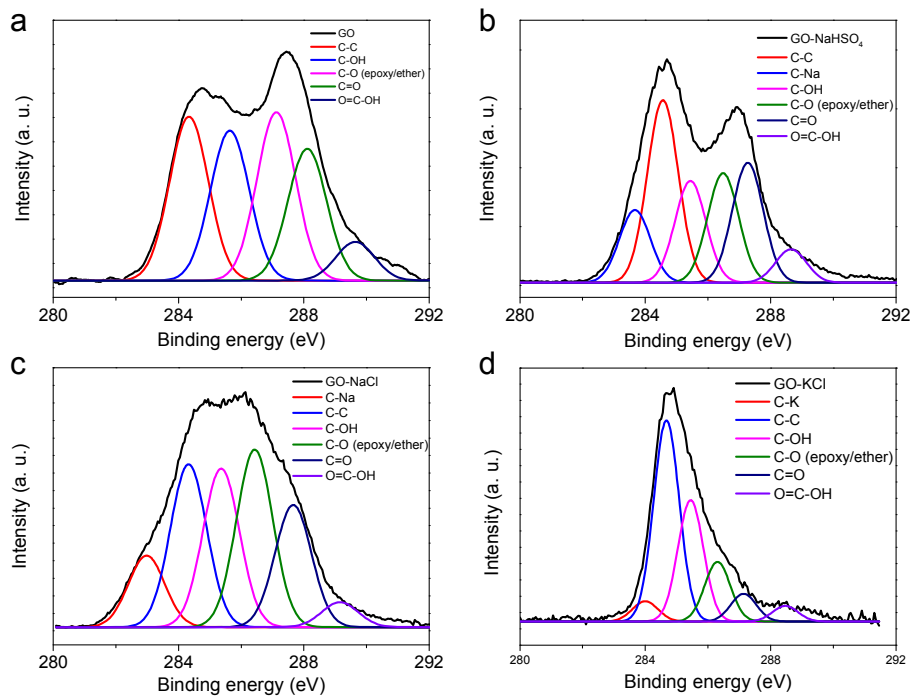


Figure S4. Arrhenius curves of the trans-membrane transport process of (a) KCl, (b) MgCl₂, (c) CaCl₂ and (d) BaCl₂ through G-O membranes. The Arrhenius curves are plotted based the following equation: $\ln\sigma/\sigma_0 = \ln A - \varepsilon/kT$.



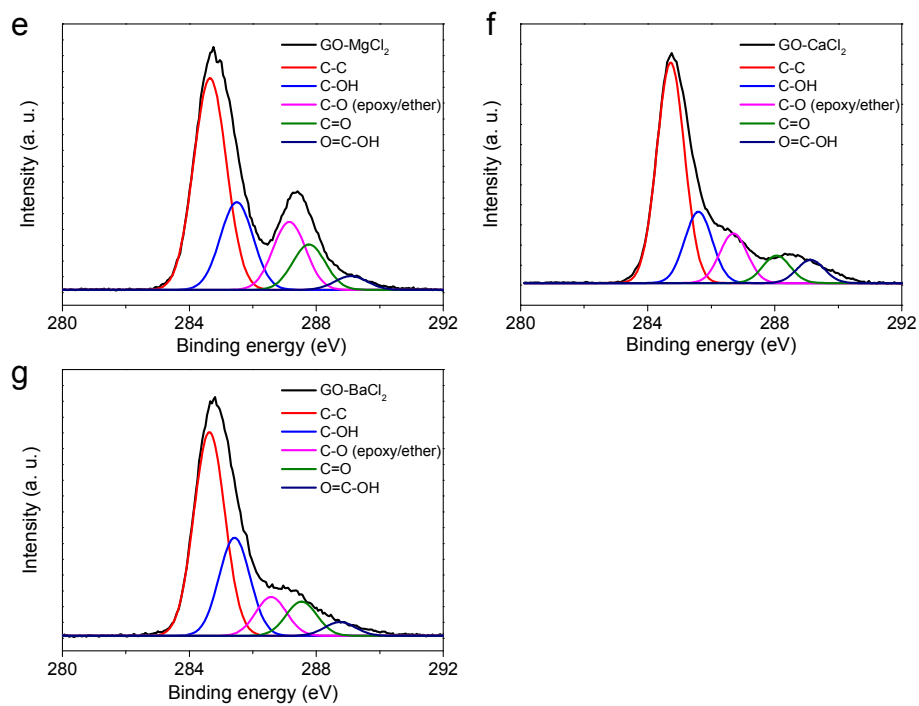


Figure S5. XPS spectra of G-O membranes (a) and those after tests for (b) NaHSO₄, (c) NaCl, (d) KCl, (e) MgCl₂, (f) CaCl₂, (g) BaCl₂. XPS spectra of NaHSO₄ and NaCl are selected from the Supporting Information of Ref. (3) as cited in the main text.

Table S1. Radius of naked and hydrated ions studied in the main text.

Ion	Na ⁺	K ⁺	Mg ²⁺	Ca ²⁺	Ba ²⁺	Cl ⁻
Radius of naked ion (Å)	0.95	1.33	0.65	0.99	1.35	1.81
Radius of hydrated ion (Å)	3.58	3.31	4.28	4.12	4.04	3.32