

Enhanced Na⁺ Transport in Cu-MOF Reinforced PEO Solid-State Polymer Electrolyte for High-Rate Sodium Metal Batteries

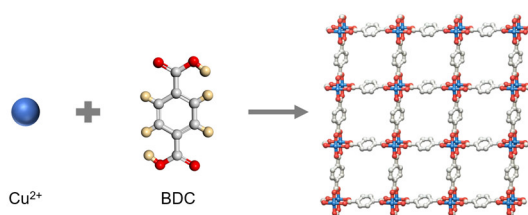


Figure S1. The components of Cu-MOF and the corresponding crystal structure.

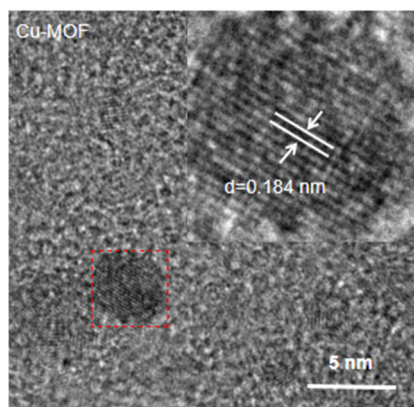


Figure S2. TEM images of Cu-MOF.

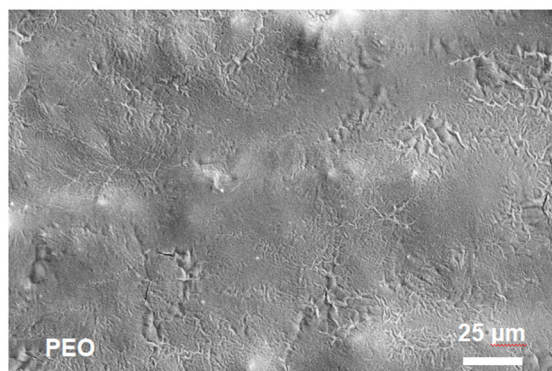


Figure S3. SEM images of PEO electrolyte membranes.

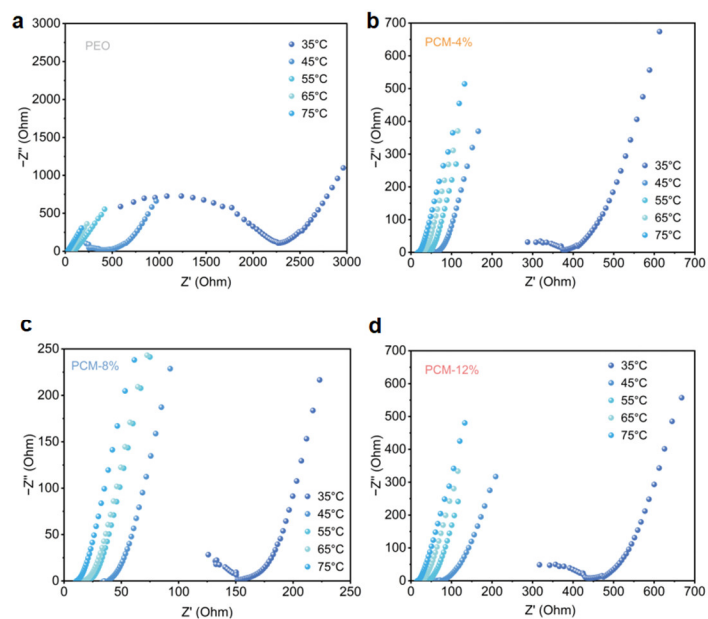


Figure S4. Nyquist plots of (a) PEO, (b) PCM-4%, (c) PCM-8% and (d) PCM-12% at different temperatures (35–75°C).

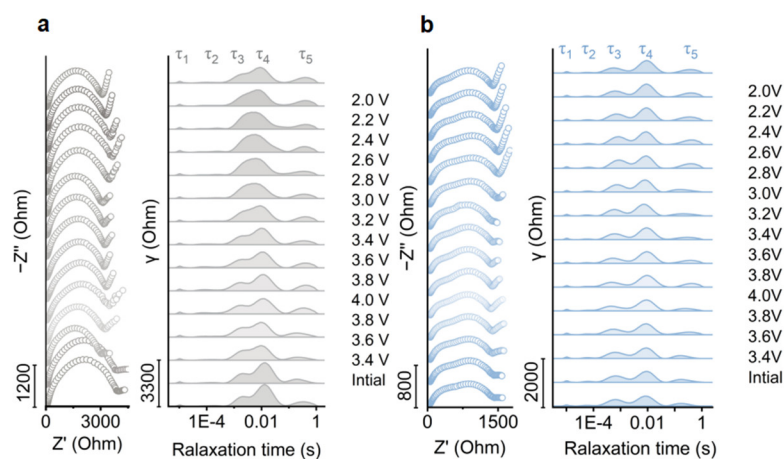


Figure S5. In situ EIS spectra during the process of the first charge/discharge and the corresponding DRT results of the Na|NVP/C cells at 0.1 C with (a) PEO and (b) PCM-8%.

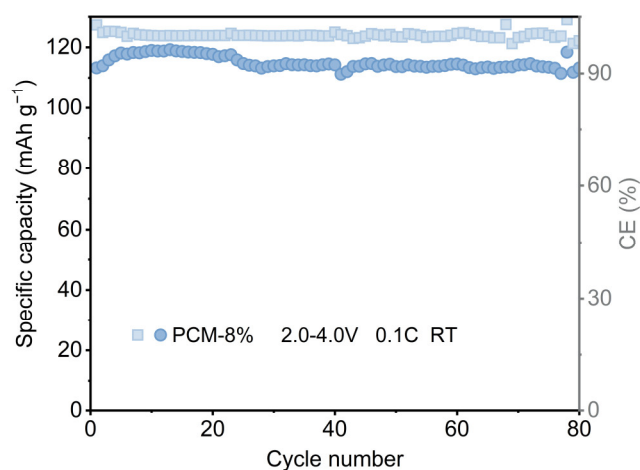


Figure S6. Cycling performance of NVP/C/PCM-8%/Na cell at room temperature under a current density of 0.1 C.

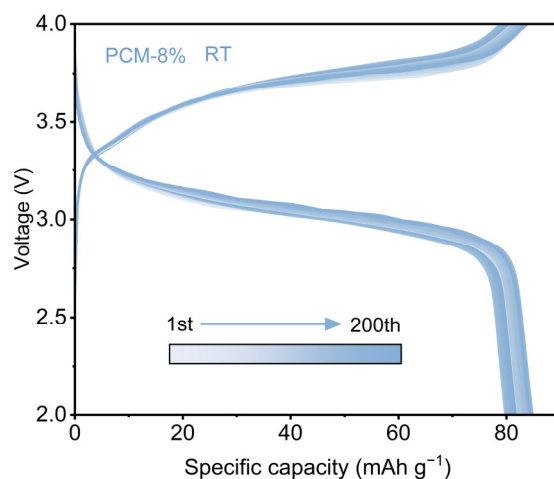


Figure S7. Charge–discharge curves of the NVP/C/PCM-8%/Na cell at room temperature under a current density of 0.5 C.

Table S1. Values of T_m , ΔH_m and χ_c of PEO, PCM-4%, PCM-8% and PCM-12% solid electrolytes from the DSC test.

Solid Electrolytes	T_m (°C)	ΔH_m (J g ⁻¹)	χ_c (%)
PEO	54.14	59.6	29.4
PCM-4%	52.96	58.4	28.7
PCM-8%	51.55	56.6	27.8
PCM-12%	54.06	58.8	28.9

The crystallinity (χ_c) was calculated by $\Delta H_m/\Delta H_{PEO}$, with ΔH_{PEO} representing the melting enthalpy of fully crystalline PEO, adopted as 203 J g⁻¹. ΔH_m represents the melting enthalpy already normalized to the PEO mass fraction.

Table S2. Room-temperature ionic conductivities of various solid electrolytes.

Solid Electrolytes	L (cm)	S (cm ²)	R_t (Ω)	σ (mS cm ⁻¹)
PEO	0.0203	2.0096	3944	0.002
PCM-4%	0.0220	2.0096	870.4	0.013
PCM-8%	0.0225	2.0096	321.7	0.033
PCM-12%	0.0229	2.0096	906.4	0.012

L is the average thickness of the membrane (cm), obtained from at least three independent measurements.