

Supporting information

TableS1 The composition of the hydrogel as shown in the chart.

Hydrogels	H ₂ O	AA	AMPS	A-T	G-C	KPS	MBA	ILs@MoS ₂
A-PS	10g	3g	1g	0g	0g	0.1g	0.005g	0.2g
AGM _{1:1}	10g	3g	1g	1g	0.1	0.1g	0.005g	0.2g
AGM _{1:3}	10g	3g	1g	1g	0.3g	0.1g	0.005g	0.2g
AGM _{1:5}	10g	3g	1g	1g	0.5g	0.1g	0.005g	0.2g
AGM _{1:7}	10g	3g	1g	1g	0.7g	0.1g	0.005g	0.2g
AGM _{1:7}	10g	0g	1g	1g	0.7g	0.1g	0.005g	0.2g
AGM _{1:7}	10g	3g	0g	1g	0.7g	0.1g	0.005g	0.2g
AGM _{1:7}	10g	0g	0g	1g	0.7g	0.1g	0.005g	0.2g
AGM _{1:7}	10g	3g	1g	0g	0g	0.1g	0.005g	0.2g

Dispersion and Stability of MoS₂

Due to its hydrophobic nature, dispersing molybdenum disulfide (MoS₂) in aqueous solutions presents challenges. To improve the dispersion of the MoS₂ nanosheets, we employed ionic liquids to enhance their dispersibility.

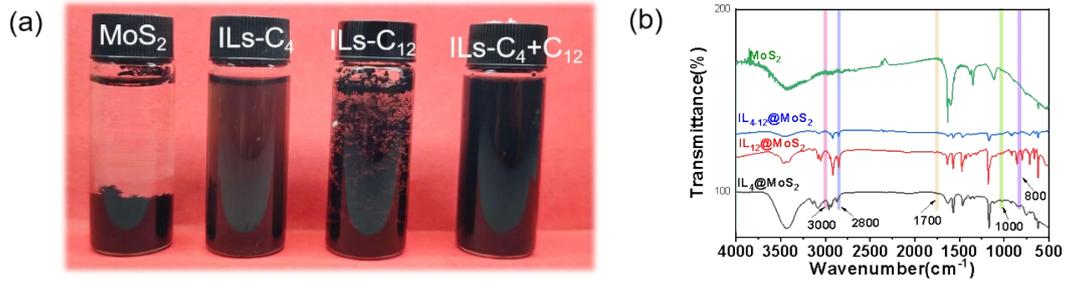


Fig.S1 a.Schematic diagram of MoS₂ dispersion; b.FT-IR spectra of MoS₂, ILS-C₄@MoS₂, ILS-C₁₂@MoS₂, and ILS-C₄+C₁₂@MoS₂.

SEM tests

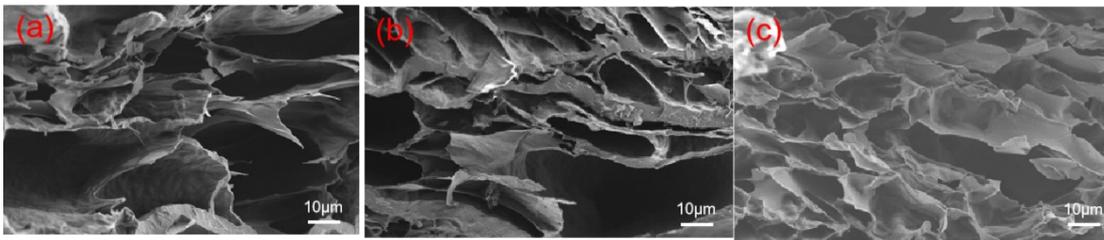


Fig.S2 SEM images of a.AA-AMPS hydrogel, b. A-PS-A-T/C-G hydrogel, and c. AGM-ILs@MoS₂ hydrogel.

Rheological Tests

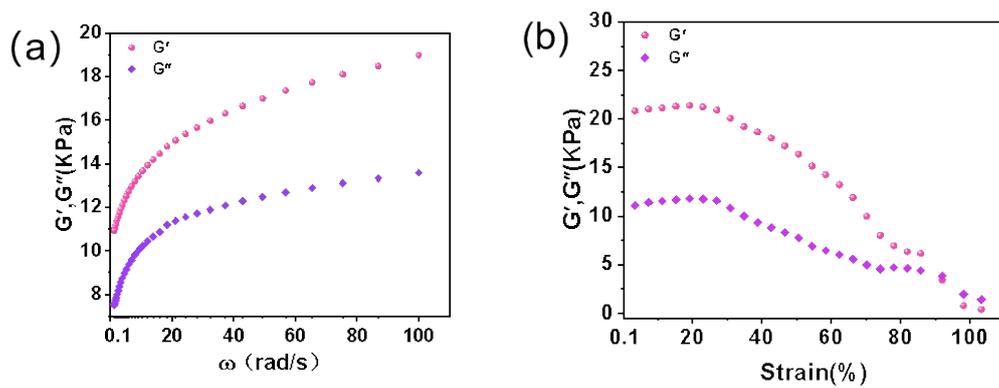


Fig.S3. Rheological properties of the AGM-ILs @MoS₂ hydrogel: a.Oscillatory amplitude sweep test; b.Oscillatory frequency sweep test.

Conductivity

Furthermore, the ILs adsorb onto the MoS₂ surface via electrostatic interactions, preventing its agglomeration and promoting its uniform dispersion. The uniform dispersion of MoS₂, combined with the construction of continuous electron pathways, enhanced carrier migration due to IL intercalation, and optimized polymer interfaces, collectively achieves high conductivity in the hydrogel.

