Polymer matrix	Solutes	Ionic conductivity (mS cm ⁻¹)	Strain at stress	Specific properties	Refs.
PDZ-H	Zn(CF ₃ SO ₃) ₂	40 at 20°C	1122% at 48.8 KPa	Inhibiting Zn dendrites; wide temperature range (-40~60°C)	63
AF-SH-CPAM	Zn(CF ₃ SO ₃) ₂	7.7 at 20°C 1.3 at -20°C	1200% at 34 KPa	Anti-freezing; self-healing	49
CSAM-C	2 M Zn(ClO ₄) ₂	23.61 at 20°C 7.8 at -30°C	620% at 350 KPa	Suppressing dendrite and side reactions; excellent compression strength (19 MPa); water retention (80.1% at 48h); frost resistance	80
MorphGE	2 M ZnSO ₄ + 0.1 M MnSO ₄	26.2 at 20°C	128% at 3.22 MPa	Suppressing dendrite and side reactions; Young's modulus (1.48 MPa)	85
MC/PAM-PDM	6 M KOH	215 at 20°C	1800% at 200 KPa	Ultra toughness; water uptake (107 g g ⁻¹); water retention (86% at 160h)	1
Starch gel electrolyte	6 M KOH + 0.5 M ZnO	111.5 at 20°C	-	low-cost; self-adhesiveness; water retention capability (84.4% at 18h)	37
PEO-PAM	LiTFSi+LiCl	6.52 at 20°C	-	Dual-layer gel electrolyte; preventing the corrosion of anode	82
PANI/CS- PAAM DN hydrogels	43.47 wt% (NH ₄) ₂ SO ₄	48.3 at 20°C	860 % at 2.62 MPa	High stretchability; ultra toughness; frost resistance; UV radiation shielding.	96
CT3G30	2 M ZnSO ₄ + 0.2 M MnSO ₄	33 at 20°C 19.4 at -40°C	846.5% at 2.11 MPa	Excellent mechanical properties; self-healing; high adhesion strength; frost resistance	53
APSE	0.5 M KOH	29 at 20°C	-	Anti-CO ₂ property (viscosity of 10 ⁷ times higher than 0.5 M KOH); self-healing	3
PAAm/PAA- Fe ³⁺ /NaCl	2 M NaCl	7.2 at 20°C	573% at 1180 KPa	Excellent fatigue resistance; Young modulus = 0.33 ± 0.04 MPa; self- healing; frost resistance	44
KI-PVAA-GO	4 M KOH + 2 M KI	155 at 20°C	500% at 70 KPa	Water retention (99% at 12h); alkali uptake (~17 g g ⁻¹); enhanced mechanical strength and ionic conductivity	100.
PVA-B-G	2 M ZnSO ₄ + 0.2 M MnSO ₄	29.6 at 25°C 10.1 at -35°C	502% at 115.5 KPa	Excellent mechanical performance at -35°C (Tensile strength: 106.9KPa; compression strength: 18 MPa)	5
DN 2.5-EG	$1 \mathrm{M} \mathrm{H}_2 \mathrm{SO}_4$	30 at 25°C 4.8 at -40°C	80% at 3.5 MPa	High compressive stress (15.5 MPa); Anti-freezing	91
MMT/PVA + DMSO	$2 \text{ M H}_2 \text{SO}_4$	0.017 at -50°C 0.076 at 90°C	22.6% at 14.3 MPa	All-temperature adaptability (- 50~90°C); enhanced mechanical	48
PANa	6 M KOH + 0.2M Zn(Ac) ₂	126 at 50°C 60 at -20°C	1400% at 50 and -20°C	Super absorbency; high stretchability (900% at -50°C)	70
PANa-cellulose	6 M KOH + 0.2M Zn(Ac) ₂	280 at 20°C	1180% at 560 KPa	Super-stretchable; increased elongation and tensile strength	34

Table S1. A summary of the intrinsic properties of the reported typical GPEs in various battery systems.