

Support information

Radiation synthesis of imidazolium ionic liquid grafted PVDF as anion exchange membrane for vanadium redox flow battery

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FIGURES:

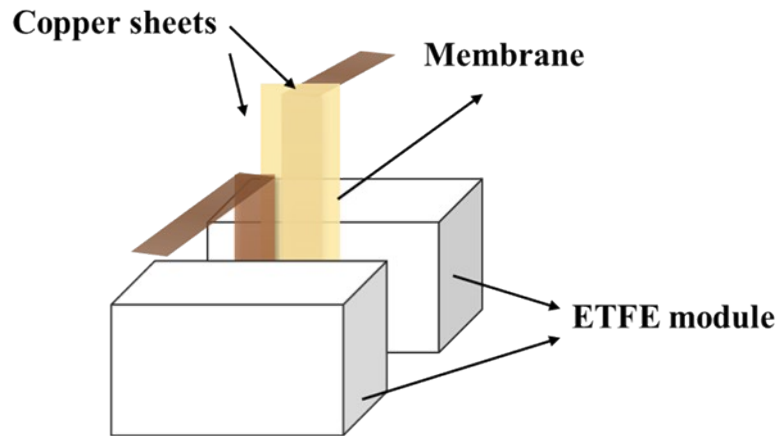


Fig. S1. The test mold of ionic conductivity.

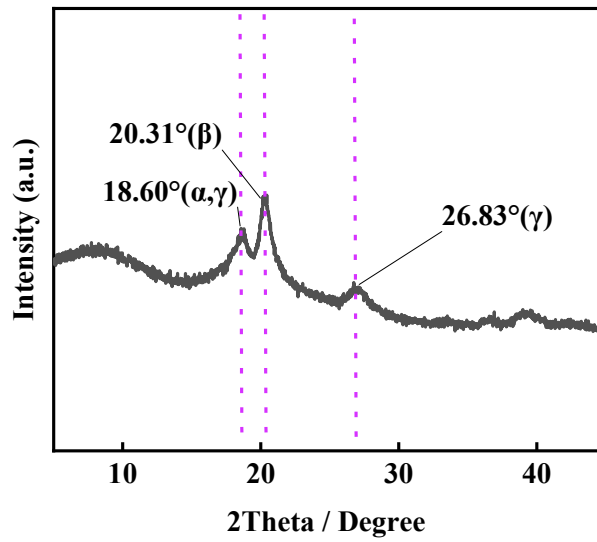


Fig. S2. The XRD spectra of the neat PVDF membrane.

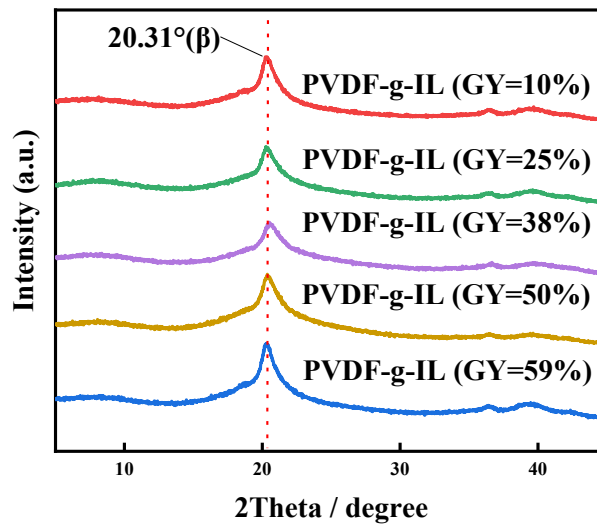


Fig. S3. The XRD spectra of the PVDF-g-IL membranes.

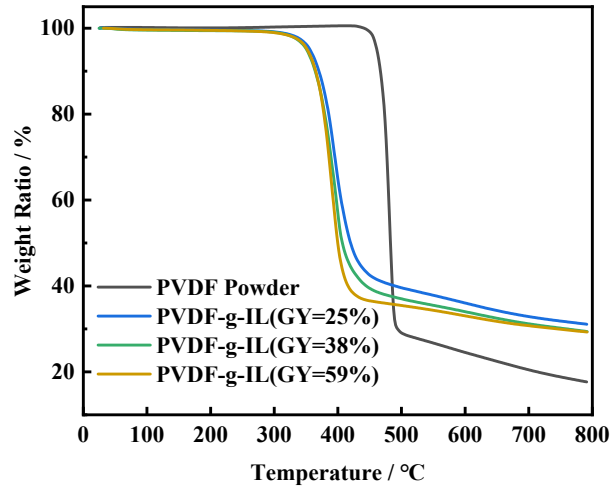


Fig. S4. The TGA curves of PVDF and PVDF-g-IL powders.

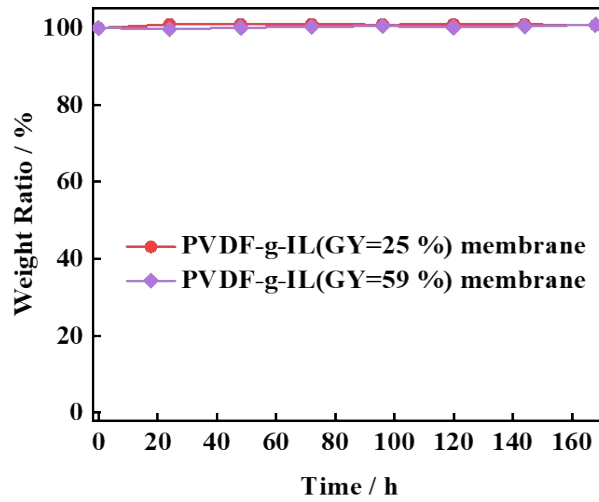


Fig. S5. The weight loss of the grafted membranes after ethanol treatment.

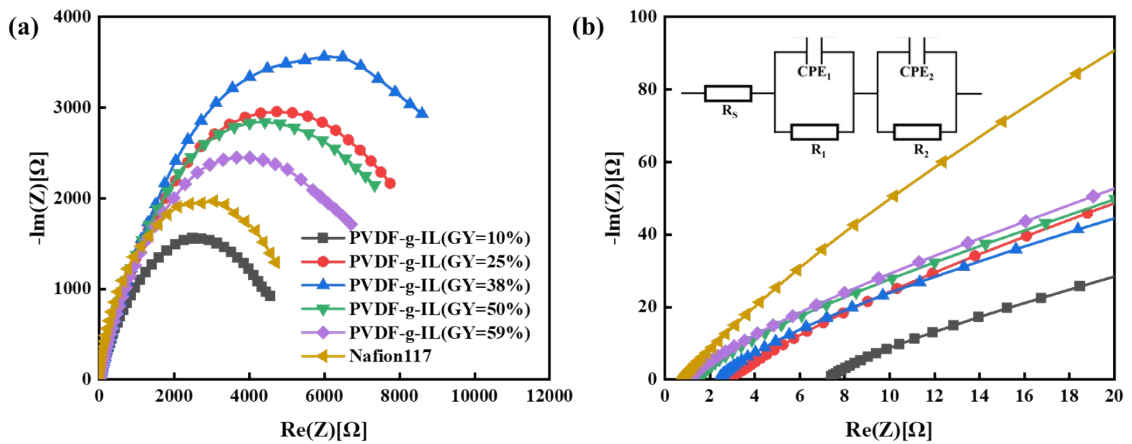


Fig. S6. (a)The EIS curves and (b)the enlarged EIS curves and the equivalent circuit model of the PVDF-g-IL membranes and Nafion117.

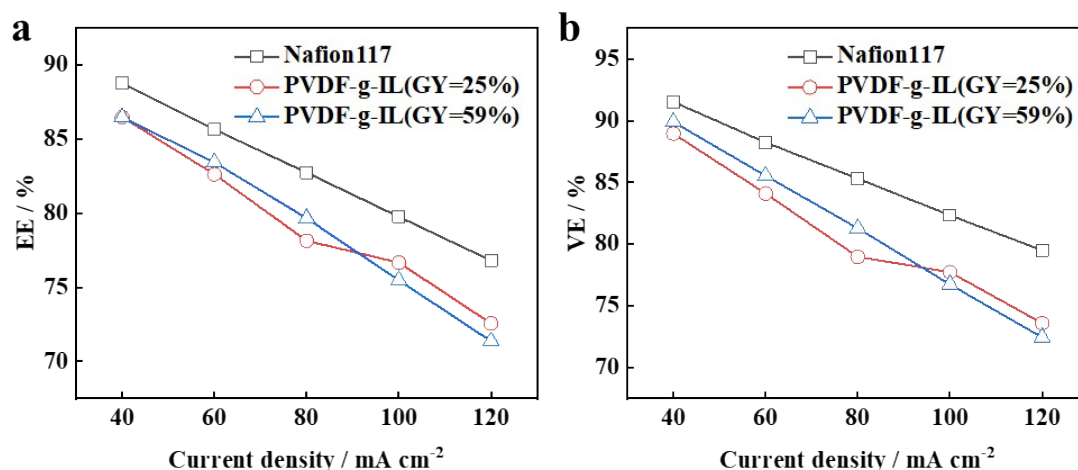


Fig. S7. The EEs (a) and VEs (b) of the PVDF-g-IL (GY=25% and 59%) membrane and Nafion117.

TABLE:

Table S1 The comparison of some AEMs in other works.

Sample	WU (%)	IEC (mmol/g)	Ion conductivity (mS/cm)	permeability ($\times 10^{-7}$ cm/min)	refs
PVDF-g-IL(GY=25%)	12.10	1.49	9.05	0.98	This work
PVDF-g-IL(GY=59%)	9.31	1.68	30.43	0.57	This work
DQA-TAPFE-20	18.2	1.55	10.1	0.031	[1]
QA-PAE-20	17.4	1.61	7.2	0.32	[2]
PBI-GTA-112%	30	2.4	9.68	2.18	[3]
ETFE-g-PDMAEMA40	21.5	1.7	-	0.05	[4]
PSf-PhBIm1.2	25.3	1.32	12.7	8.52	[5]

Table S2 The efficiency performance comparison of PVDF-IL(GY=25%) membrane with the commercial anion-exchange membranes [6].

Sample	Thickness (μm)	Ion conductivity (mS/cm)	Permeability ($\times 10^{-7}$ cm/min)	CE (%)	VE (%)	EE (%)
FAP-PP-475	70	17.8	22.4	92.6	85	78.7
FAP-PE-420	20	5	11.6	91.0	86	78.0
APS	150	176	2.5	89.3	87	77.7
PVDF-IL(GY=25%)	123	9.05	0.98	98.25	84.10	82.63

Table S3. The cost of the material and radiation for preparing 1 m² membrane

Material	Unit price	Required amount	Cost
[VEIm][BF ₄]	\$72.8 / 100g	60g	\$43.68
PVDF	\$37.8 / kg	40g	\$1.52
Ethanol	\$1 / 500ml	1000ml	\$2
NMP	\$4 / L	500ml	\$2
Radiation	\$500-700 / ton	40 g PVDF	\$0.02-0.028
Overall			\$49.22-\$49.228

Reference

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