

## Supplementary Information

### **A moisture stable high-entropy halide electrolyte with performance recovery capability for all-solid-state batteries**

Jingran Fu,<sup>1,2,3</sup> Hongyang Zhang,<sup>1,2,3</sup> Yuan Tian,<sup>1,2,3</sup> Lue Wang,<sup>1,2,3</sup>

Chunrong Zhao<sup>1,2,3</sup> and Rong Yang<sup>\*1,2,3</sup>

1 National Power Battery Innovation Center, GRINM Group Corporation Limited, Beijing 100088, P.R. China.

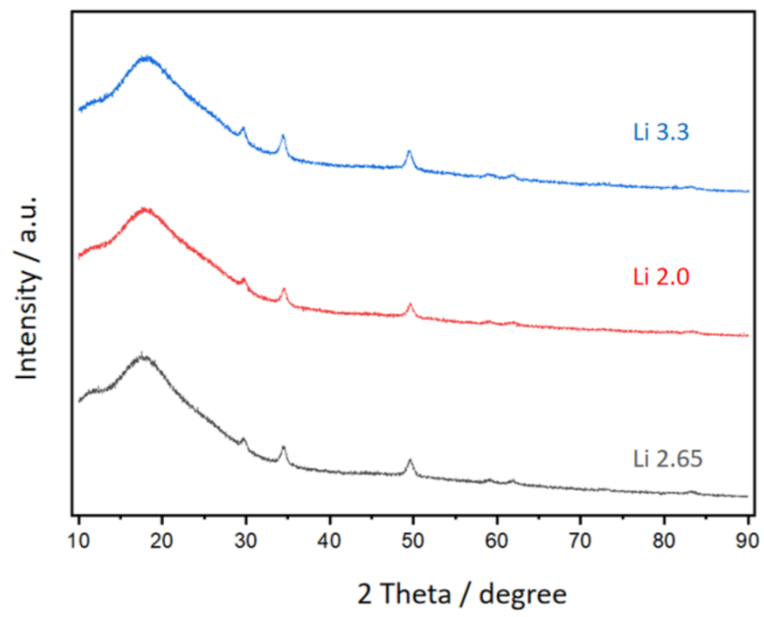
2 China Automotive Battery Research Institute Co. Ltd., Beijing 100088, P.R. China.

3 General Research Institute for Nonferrous Metals, Beijing 100088, P.R. China.

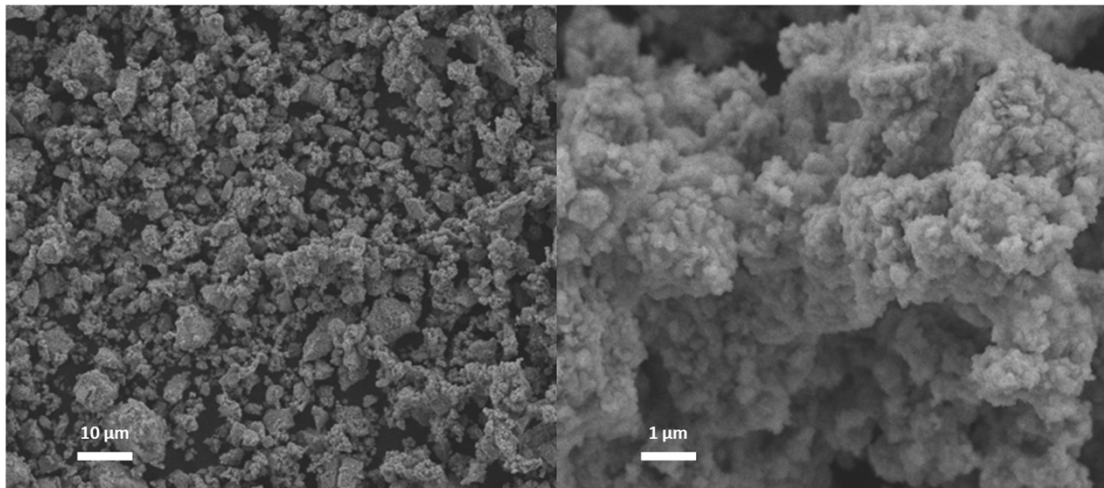
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Fig S1-4

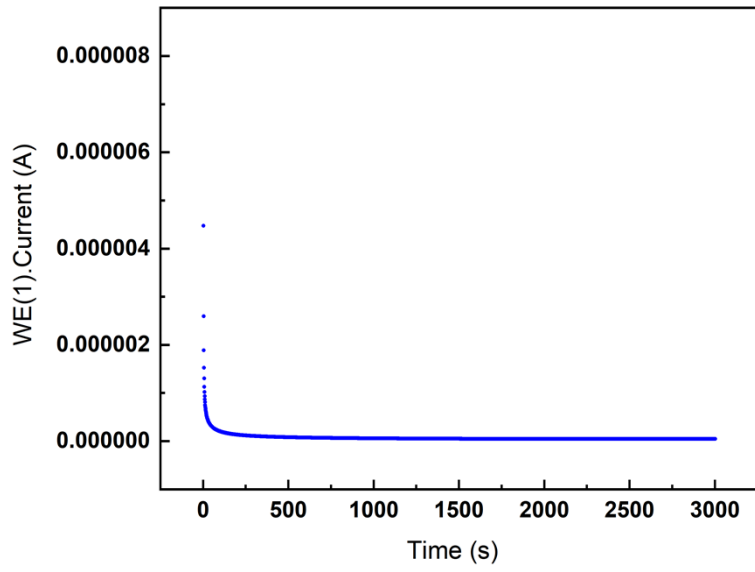
Table S1-3



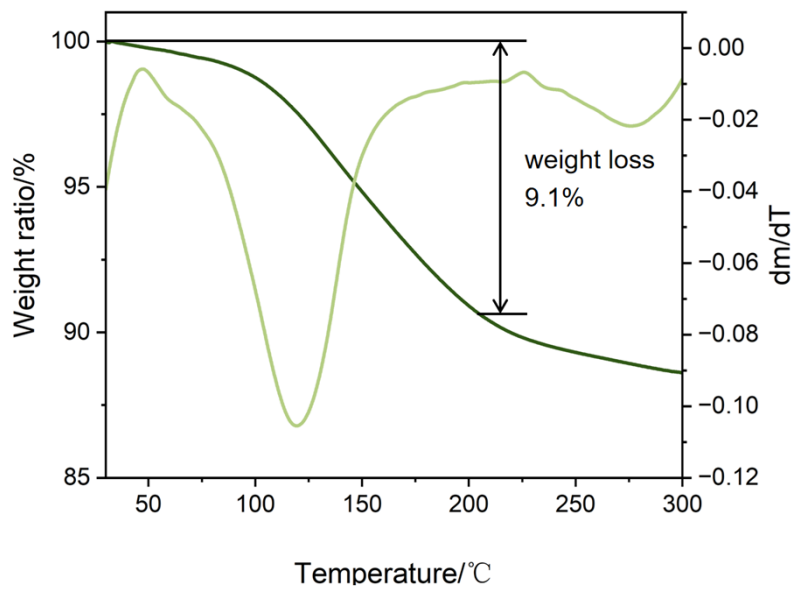
**Fig S1.** XRD patterns of HE-25 with different Li contents.



**Fig S2.** SEM result of HE-25.



**Fig S3.** DC curve of HE-25.



**Fig S4.** TGA result of exposed HE-25.

**Table S1.** The laboratory-scale price of raw materials obtained from the official website of Aladdin.

Chemical name and description	Stock No.	Purchase quantity, Q, grams	Total purchase price, RMB	Unit price, RMB/5kg
Indium(III) chloride, PrimorTrace™, anhydrous, ≥99.99% (metals basis)	I196212-5g	5	132.90	132900
	I196212-25g	25	427.90	85580
	I196212-100g	100	1567.90	78395
	I196212-500g	500	5953.90	59539
Iron(III) chloride, ≥98%	I141414-100g	100	31.90	1595
	I141414-500g	500	89.90	899
	I141414-5kg	5000	579.90	580
Zirconium chloride, ≥98%,	Z109459-25g	25	49.90	9980
	Z109459-100g	100	102.90	5145
	Z109459-500g	500	399.90	3999
Tantalum(V) chloride, ≥95%(T)	T161496-5g	5	114.90	114900
	T161496-25g	25	417.90	83580
	T161496-100g	100	1523.90	76195
Zinc chloride, ≥95%	Z293771-500g	500	136.90	1369
	Z293771-2.5kg	2500	419.90	840
Yttrium(III) chloride, anhydrous, ≥99.95% (metals basis), powder	Y119224-10g	10	148.90	74450
	Y119224-50g	50	423.90	42390
	Y119224-250g	250	1470.90	29418
Erbium(III) chloride, anhydrous, ≥99.9% (metals basis), powder	E119222-1g	1	99.90	499500
	E119222-10g	10	469.90	234950
	E119222-50g	50	1876.90	187690
	E119222-250g	250	8017.90	160358
Ytterbium(III) chloride, anhydrous, ≥99.9% (metals basis), powder	Y137958-1g	1	209.90	1049500
	Y137958-5g	5	770.90	770900

Chemical name and description	Stock No.	Purchase quantity, Q, grams	Total purchase price, RMB	Unit price, RMB/5kg
	Y137958-25g	25	3625.90	725180
Hafnium(IV) chloride, $\geq 98\%$	H431977-10g	10	407.90	203950
	H431977-50g	50	1425.90	142590
Scandium(III) chloride, anhydrous, $\geq 99.9\%$ (metals basis), powder	S137955-1g	1	1740.90	8704500
	S137955-5g	5	5634.90	5634900
Lithium chloride, $\geq 98\%$	L573368-100g	100	89.90	4495
	L573368-500g	500	399.90	3999
	L573368-2.5kg	2500	1599.90	3200

**Table S2.** Estimated cost of raw materials when purchased in the quantity of 1000 kg.

Chemical formula	Intercept [ $\log_{10}(a)$ ]	Slope [b]	Absolute correl. coeff.	Unit price in bulk (1000 kg) purchase, RMB/kg
InCl <sub>3</sub>	4.5129	-0.1652	0.9727	3326.5
FeCl <sub>3</sub>	2.9853	-0.2540	0.9841	28.92
ZrCl <sub>4</sub>	3.6842	-0.3013	0.9563	75.24
TaCl <sub>5</sub>	4.4455	-0.1389	0.9656	4096.0
ZnCl <sub>2</sub>	3.2563	-0.3035	1.0000	27.24
YCl <sub>3</sub>	4.4470	-0.2884	0.9923	520.6
ErCl <sub>3</sub>	4.9498	-0.2054	0.9615	5216.0
YbCl <sub>3</sub>	5.3040	-0.1147	0.9318	41280
HfCl <sub>4</sub>	4.8330	-0.2224	1.0000	3152.0
ScCl <sub>3</sub>	6.2407	-0.2700	1.0000	41760
LiCl	3.1723	-0.1055	0.9830	346.0

**Table S3.** Estimated unit price of electrolytes.

Chemical formula	Unit price of precursors in bulk (1000 kg) purchase, RMB/kg
Li <sub>2.6</sub> Zr <sub>0.2</sub> Ta <sub>0.2</sub> In <sub>0.2</sub> Zn <sub>0.2</sub> Fe <sub>0.2</sub> Cl <sub>6</sub> (HE-20)	1457
Li <sub>2.49</sub> Zr <sub>0.23</sub> Ta <sub>0.23</sub> In <sub>0.23</sub> Zn <sub>0.15</sub> Fe <sub>0.15</sub> Cl <sub>6</sub> (HE-23)	1627
Li <sub>2.65</sub> Zr <sub>0.25</sub> Ta <sub>0.25</sub> In <sub>0.16</sub> Zn <sub>0.16</sub> Fe <sub>0.16</sub> Cl <sub>6</sub> (HE-25)	1570
Li <sub>2.8</sub> Zr <sub>0.2</sub> In <sub>0.8</sub> Cl <sub>6</sub>	1850
Li <sub>3</sub> Y <sub>0.2</sub> In <sub>0.8</sub> Cl <sub>6</sub>	1902
Li <sub>3</sub> InCl <sub>6</sub>	2238
Li <sub>2.2</sub> In <sub>0.2</sub> Sc <sub>0.2</sub> Zr <sub>0.2</sub> Hf <sub>0.2</sub> Ta <sub>0.2</sub> Cl <sub>6</sub>	5547
Li <sub>2.75</sub> Y <sub>0.16</sub> Er <sub>0.16</sub> Yb <sub>0.16</sub> In <sub>0.25</sub> Zr <sub>0.25</sub> Cl <sub>6</sub>	6588

**Tab S4.** Rietveld refinement result from XRD result of HE-25 after 300°C anneal.

Li <sub>2.65</sub> Zr <sub>0.25</sub> Ta <sub>0.25</sub> In <sub>0.16</sub> Fe <sub>0.16</sub> Cl <sub>6</sub> Space group: <i>C2/m</i>						
$a=6.40287 \text{ \AA}$ , $b=10.99658 \text{ \AA}$ , $c=6.31389 \text{ \AA}$ , $\beta=109.73652^\circ$						
Atom	x	y	z	Occupancy	Wyckoff site	Uiso ( $\text{\AA}^2$ )
Li 1	0	0.33685	0.50000	0.883	4h	0.126
Li 2	0.50000	0	0.50000	0.883	2d	0.275
Zr 1/Ta 1/	0	0	0	0.875	2a	0.019

In 1/Zn 1/Fe 1						
Zr 2/Ta 2/ In 2/Zn 2/Fe 2	0	0.30651	0	0.070	4g	0.042
Cl 1	0.26852	0.16338	0.23547	1	8j	0.031
Cl 2	0.25486	0	0.75031	1	4i	0.030