

## Supplementary Material

**Table S1.** Average chemical composition of corrosion reaction products formed on the metal surfaces of the positive battery pole.

Experiment	Measurement location	Composition of the corrosion products /wt%								
		Fe	Ni	Al	O	P	Si	Cl	Na	
0.15 m NaCl	Oxide on steel	Average	66,30	3,82	0,99	29,98	0,26	0,17	0,33	1,55
		Std Dev	4,90	1,80	0,62	4,81	0,15	0,26	0,42	0,67
	Oxide on Al		<b>Fe</b>	<b>Ni</b>	<b>Al</b>	<b>O</b>	<b>P</b>	<b>F</b>	<b>Cl</b>	
		Average	1,74	1,17	38,89	44,15	7,55	7,44	1,70	
		Std Dev	2,27	0,36	5,42	7,12	3,29	4,72	1,39	
1 m NaCl 100 min	Deposit on steel		<b>Fe</b>	<b>Ni</b>	<b>Al</b>	<b>O</b>	<b>P</b>	<b>F</b>	<b>Cl</b>	<b>Na</b>
		Average	0,98	0,47	11,29	8,54	4,93	9,52	0,98	0,18
		Std Dev	1,26	0,29	4,21	2,46	1,86	4,66	0,77	0,11
1 m NaCl 180 min	Deposit on steel		<b>Fe</b>	<b>Ni</b>	<b>Al</b>	<b>O</b>	<b>P</b>	<b>F</b>	<b>Cl</b>	<b>Na</b>
		Average	13,86	1,01	3,07	9,05	5,44	10,24	3,10	0,21
		Std Dev	3,48	0,15	1,49	4,74	1,57	2,25	1,82	0,08
	Deposit on Al		<b>Fe</b>	<b>Ni</b>	<b>Al</b>	<b>O</b>	<b>P</b>	<b>F</b>	<b>Cl</b>	<b>Na</b>
		Average	0,60	0,49	11,04	10,19	4,53	11,87	0,62	0,46
		Std Dev	0,22	0,22	4,10	3,52	0,82	3,03	0,22	0,21
Precipitate	NaCl crystals		<b>Fe</b>		<b>Al</b>	<b>O</b>		<b>F</b>	<b>Cl</b>	<b>Na</b>
		Average	1,78		0,73	5,07		0,73	56,85	36,62
		Std Dev	2,21		0,97	3,34		0,26	4,47	3,63
	Oxide particles		<b>Fe</b>	<b>Ni</b>	<b>Al</b>	<b>O</b>			<b>Cl</b>	<b>Na</b>
		Average	39,59	2,06	11,00	31,95			10,21	6,45
		Std dev	11,21	0,27	3,32	7,79			5,27	3,48
	Al(OH) <sub>3</sub>		<b>Fe</b>		<b>Al</b>	<b>O</b>			<b>Cl</b>	
		Average	2,67		34,91	61,15			1,26	

**Table S2.** Average chemical composition of corrosion reaction products formed on the metal surfaces of the positive battery pole in the electrolyte solution during discharging in NaCl + ZnSO<sub>4</sub> and NaCl + ZnCl<sub>2</sub> solutions.

Experiment	Measurement location	Composition of the corrosion products / wt%									
		O	F	Al	Si	P	S	Cl	Fe	Zn	
1 m NaCl + 0.3 m ZnSO <sub>4</sub>	oxide on steel		<b>O</b>	<b>F</b>	<b>Al</b>	<b>Si</b>	<b>P</b>	<b>S</b>	<b>Cl</b>	<b>Fe</b>	<b>Zn</b>
		Average	24,21	10,10	1,99	0,69	1,18	2,27	1,10	43,94	18,35
		StDev	4,85	3,81	0,79	0,45	0,53	0,88	0,28	5,21	8,53
	Oxide on Al		<b>O</b>	<b>F</b>	<b>Al</b>	<b>S</b>	<b>Cl</b>	<b>Fe</b>	<b>Zn</b>		
		Average	55,34	4,94	29,41	4,97	3,55	1,00	1,28		
		StDev	11,03	6,55	2,44	1,50	2,20	1,07	0,97		
	Particles in the solution		<b>O</b>	<b>Al</b>	<b>S</b>	<b>Cl</b>	<b>Fe</b>	<b>Ni</b>	<b>Zn</b>		
		Average	7,65	1,29	0,33				89,47		

	StDev	1,42	0,33	0,11					1,68	
	<b>ZnO particles</b>	<b>O</b>	<b>Al</b>	<b>S</b>	<b>Cl</b>	<b>Fe</b>	<b>Ni</b>	<b>Zn</b>		
	Average	16,19	3,03	1,69	0,19				78,49	
	StDev	3,69	3,71	0,93	0,14				4,50	
3 m NaCl 2.5 m ZnSO4	<b>Deposit on the steel</b>	<b>O</b>	<b>F</b>	<b>Si</b>	<b>S</b>	<b>Cl</b>	<b>Fe</b>	<b>Ni</b>	<b>Zn</b>	
	Average	13,78	1,26	0,21	5,92	2,74	3,59	1,25	71,82	
	StDev	3,59	0,57	0,08	1,95	0,86	4,41	1,22	4,18	
	<b>Zn particles</b>	<b>O</b>	<b>Al</b>	<b>Si</b>	<b>Fe</b>	<b>Ni</b>	<b>Zn</b>			
	Average	1,27	0,46	0,22	0,26	0,44	97,96			
	StDev	0,99	0,05	0,05	0,09	0,23	0,78			
	<b>ZnO particles</b>	<b>O</b>	<b>F</b>	<b>Al</b>	<b>Si</b>	<b>S</b>	<b>Cl</b>	<b>Fe</b>	<b>Ni</b>	<b>Zn</b>
	Average	15,56	0,82	5,80	0,26	4,40	2,48	1,15	0,67	73,85
	StDev	2,82	0,85	1,69	0,09	1,75	1,05	0,78	0,47	4,71

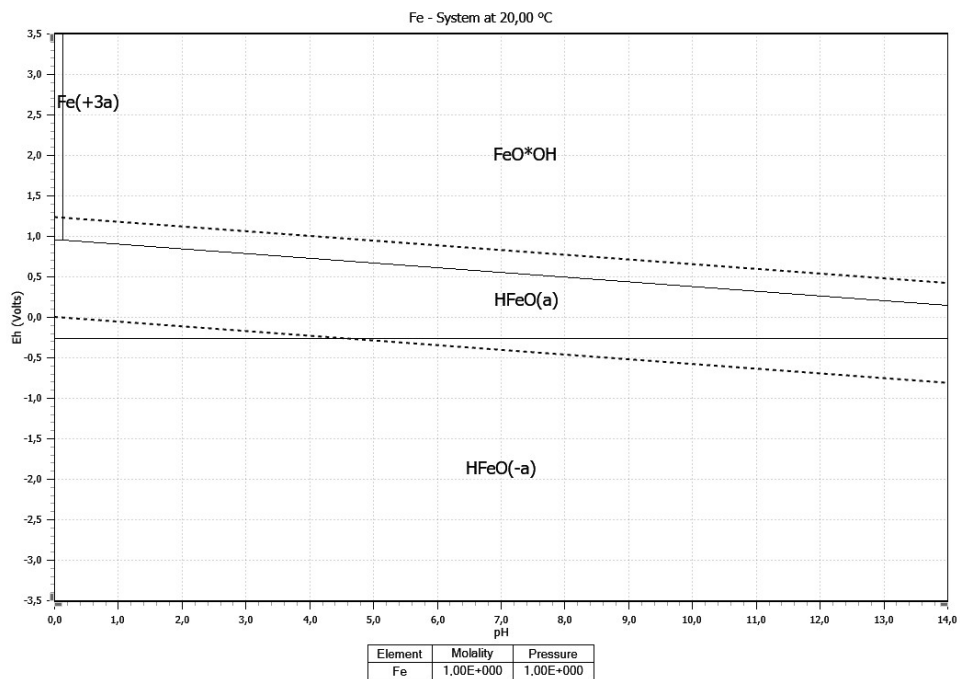
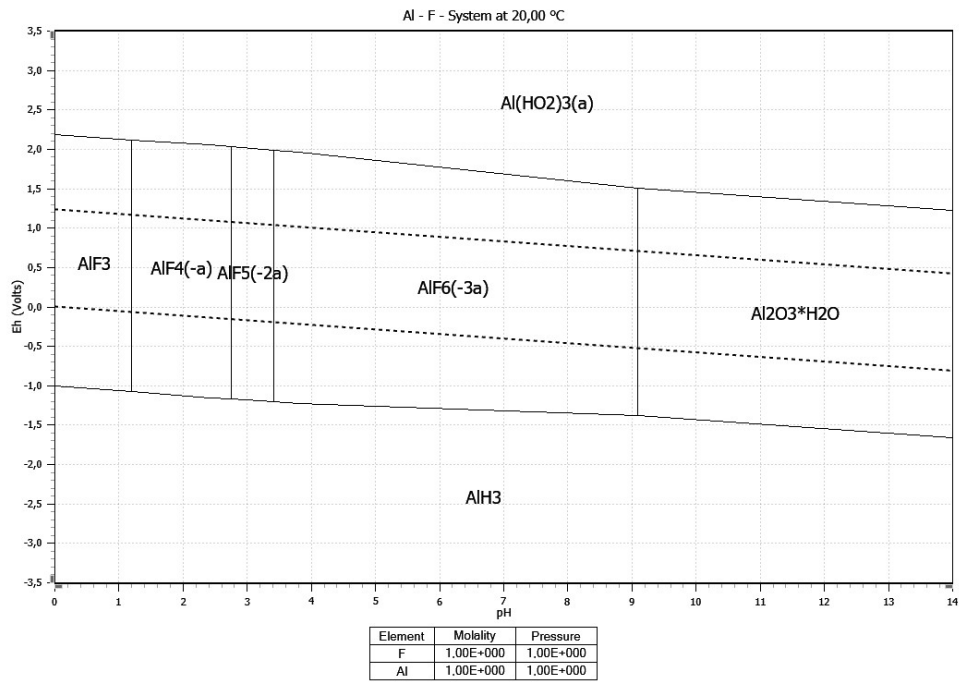
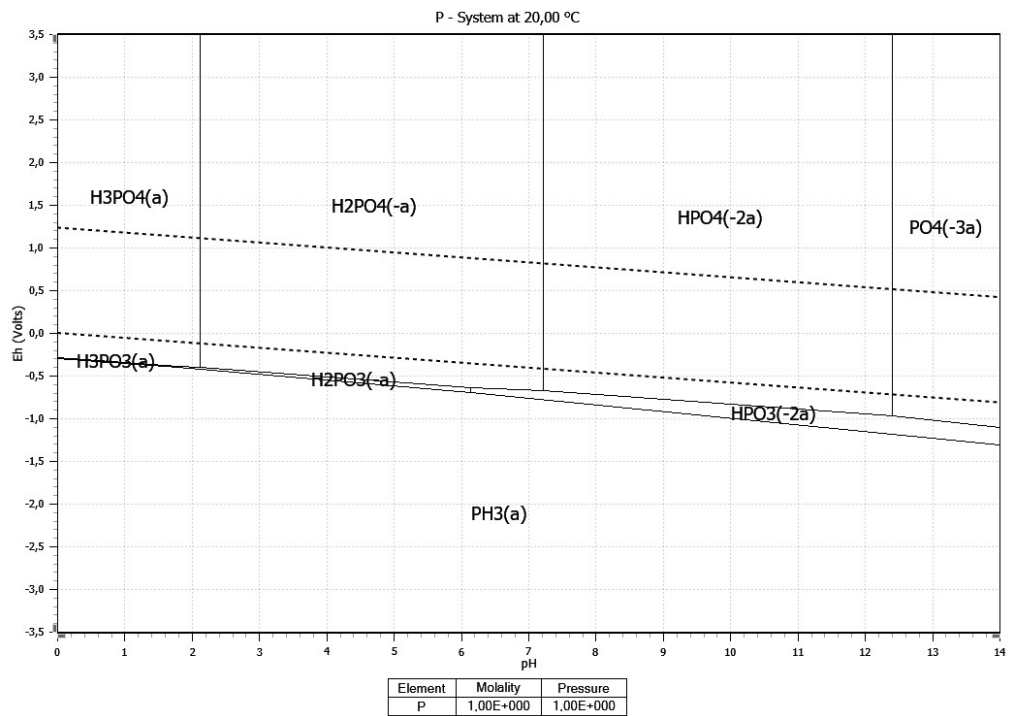


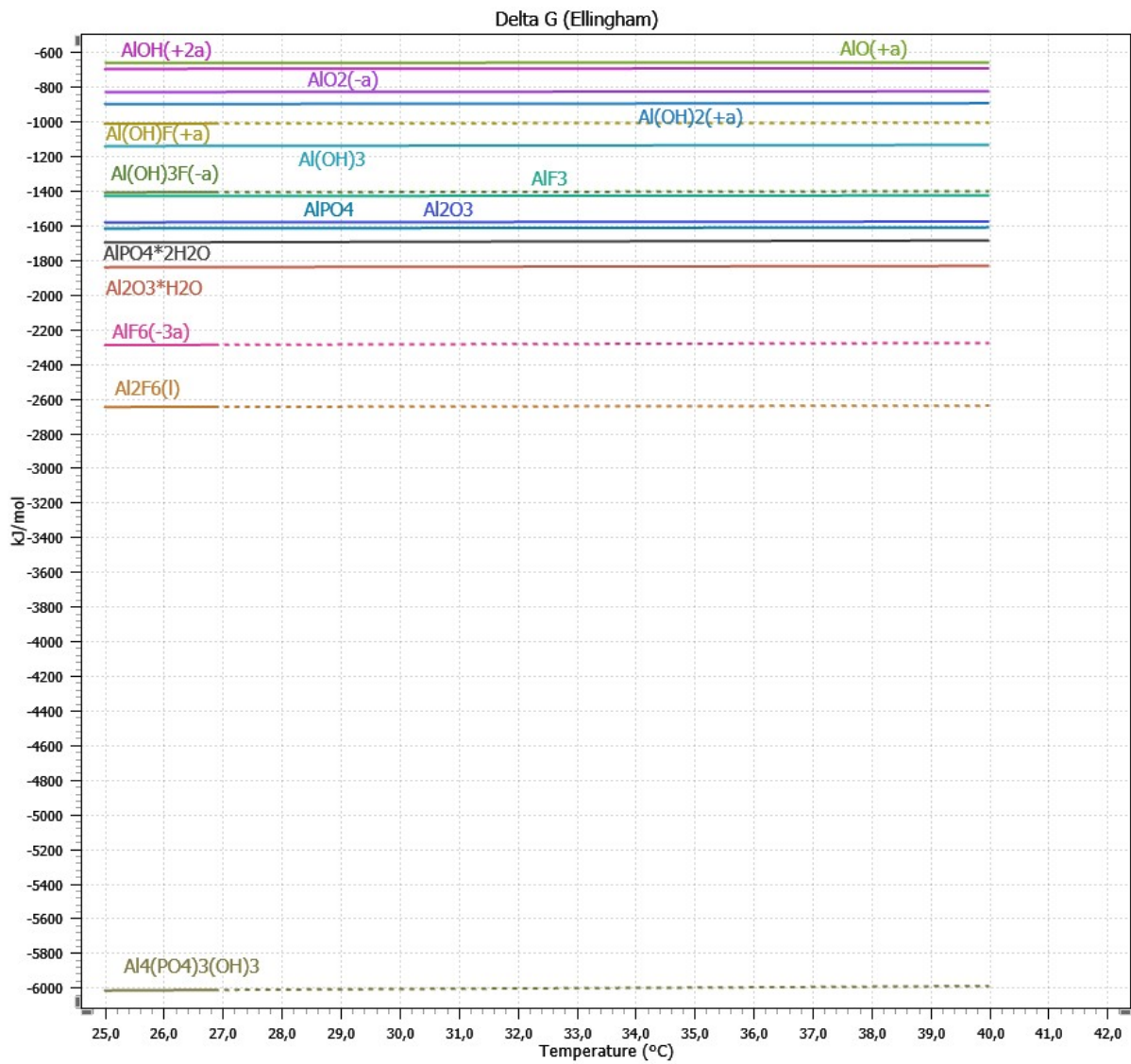
Figure S1. Pourbaix Diagram of Iron drawn with HSC Chemistry.



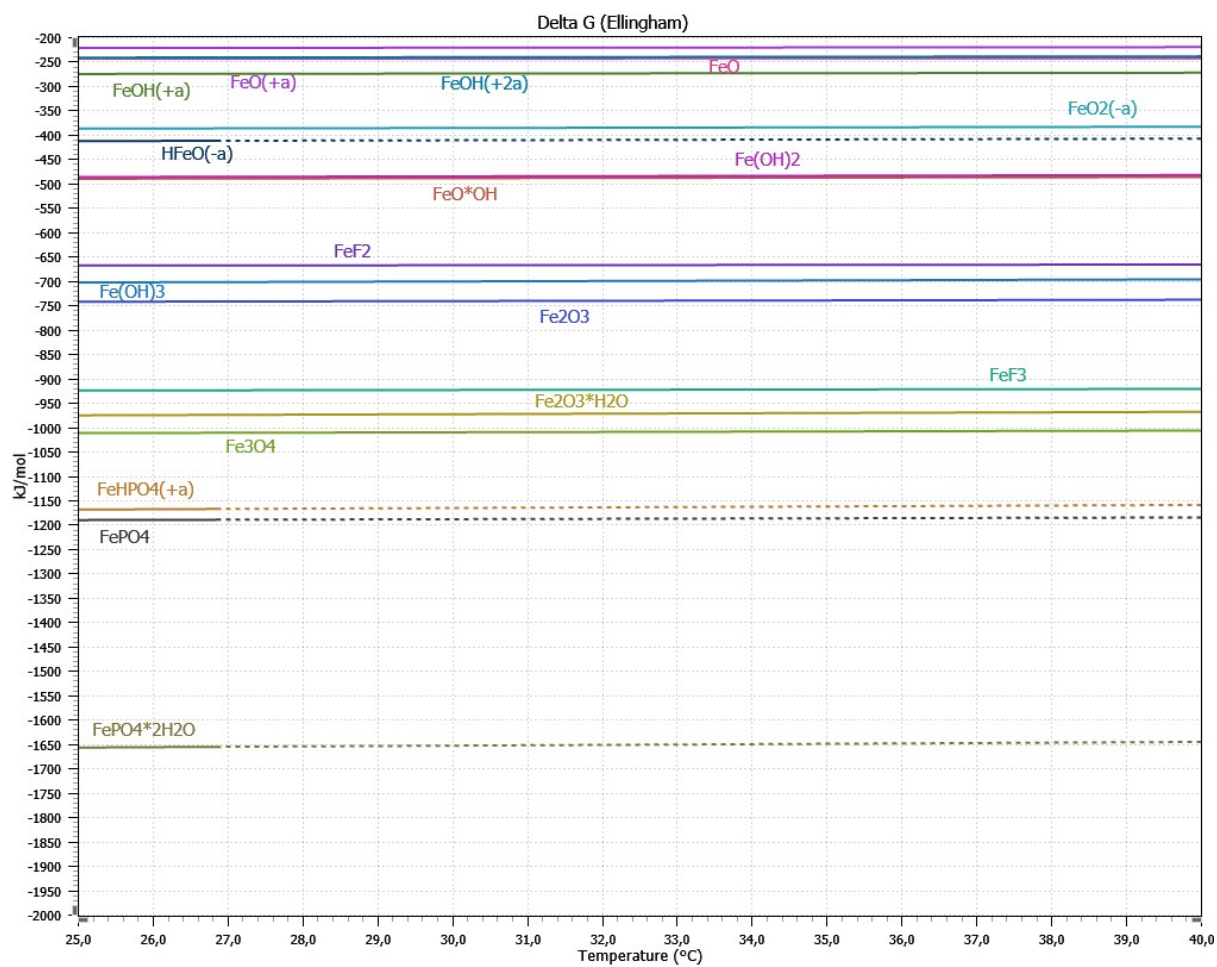
**Figure S2.** Pourbaix diagram of the Aluminium-fluorine system drawn with HSC Chemistry.



**Figure S3.** Pourbaix diagram of phosphorous drawn with HSC Chemistry.



**Figure S4.** Reaction Gibbs energies of the Al-O-H-F-P- system.



**Figure S5.** Reaction Gibbs energies of the Fe-O-H-F-P- system.

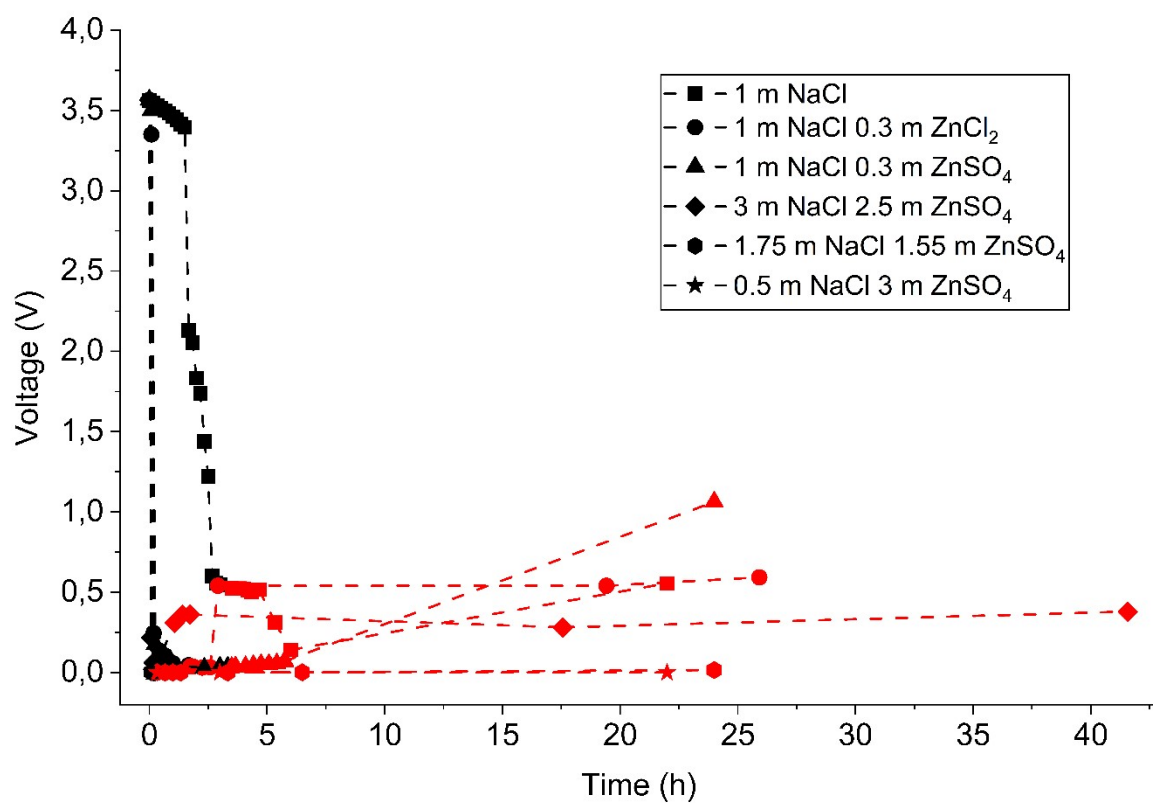


Figure S6. Discharging rate of LIBs in electrolyte solutions with different NaCl and ZnSO<sub>4</sub> concentrations. Red datapoints represent voltage relaxation behaviour after the discharging experiments.