

Supplementary Information

X-Ray Photoelectron Spectroscopy Analysis of Reference Compounds for Studying Rechargeable Li-, Na-, and K-ion Batteries

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Table S1 List of materials used in this study, including their chemical composition, supplier, purity, and sample-preparation conditions.

	Supplier	Composite Electrode	Prep. in GB	Os Coating
Si	Aldrich, <100nm	Si:Graphite:AB:PVdF = 30:50:10:10		
SiO	Osaka Titanium, 5 μ m	SiO : AB : PVdF = 80 : 10 : 10		
NMC111	Nippon Chemical Industrial	NMC111 : AB : PVdF = 80 : 10 : 10		
Na ₂ O ₂	>97%, Aldrich	Na ₂ O ₂ : AB : PVdF = 80 : 10 : 10	✓	
KO ₂	Wako Chemical	KO ₂ : AB : PVdF = 80 : 10 : 10	✓	
Graphite	SNO-3, SEC carbon	Graphite : KB : PVdF = 80 : 10 : 10		
HC	Carbotoron P(J), Kureha	HC : AB : PANa = 85 : 10 : 5		
KB	EC600JD, Lion	KB : PVdF = 80 : 20		
AB	Denka Black Li-435	AB : PVdF = 80 : 20		
PVdF	Polyscience	PVdF : AB = 80 : 20		
PANa	Kishida Chemical, DP=22000-66000	PANa : AB = 80 : 20		
SBR	Nippon A&L	SBR : AB = 80: 20		
CMC	Daicel Miraizu, #2200	CMC : AB = 80 : 20		
LiF	Aldrich	LiF : KB : PVA = 80 : 10 : 0.5	✓	✓
LiFSA	Battery Grade, Kishida Chemical	LiFSA : KB : PVA = 80 : 10 : 0.5	✓	
LiTFSA	>99.0%, TCI	LiTFSA : KB : PVA = 80 : 10 : 0.5	✓	
NaTFSA	Battery Grade, Kishida Chemical	NaTFSA : KB : PVA = 80 : 10 : 0.5	✓	
KTFSA	>99.8%, Kanto Chemical	KTFSA : KB : PVA = 80 : 10 : 0.5	✓	
LiPF ₂ O ₂	>98.0%, TCI	LiPF ₂ O ₂ : KB : PVA = 10 : 10 : 4	✓	✓
NaPF ₆	Battery Grade, Kishida Chemical	NaPF ₆ : KB : PVA = 80 : 10 : 0.5	✓	✓
Ti ³⁺ (Ti ₂ O ₃)	>99.9%, TCI	Ti ₂ O ₃ : AB : PVA = 80 : 10 : 10		
Ti ⁴⁺ (Li ₄ Ti ₅ O ₁₂)	Toshima Manufacturing	Li ₄ Ti ₅ O ₁₂ : AB : PVdF = 80 : 10 : 10		
V ³⁺ (V ₂ O ₃)	Wako Chemical	V ₂ O ₃ : KB : PVdF = 80 : 10 : 10		
V ⁴⁺ (VO ₂)	>99%, TCI	VO ₂ : AB : PVA = 80 : 10 : 10		
V ⁵⁺ (V ₂ O ₅)	>99.0%, Kanto Chemical	V ₂ O ₅ : KB : PVdF = 80 : 10 : 10		
Cr ³⁺ (Cr ₂ O ₃)	>98.5%, Kanto Chemical	Cr ₂ O ₃ : KB : PVdF = 80 : 10 : 10		
Mn ²⁺ (MnO)	>99%, Aldrich	MnO : AB : PVA = 80 : 10 : 10		
Mn ³⁺ (Mn ₂ O ₃)	>98%, Kishida Chemical	Mn ₂ O ₃ : KB : PVdF = 80 : 10 : 10		
Mn ⁴⁺ (MnO ₂)	>85%, Kanto Chemical	MnO ₂ : AB : PVA = 80 : 10 : 10		
Fe ²⁺ (LiFePO ₄)	Hohsen Corp.	LiFePO ₄ : KB : PTFE = 80 : 10 : 10		
Fe ³⁺ (Fe ₂ O ₃)	99.0~101.0%, Kanto Chemical	Fe ₂ O ₃ : KB : PVdF = 80 : 10 : 10		
Co ²⁺ (CoO)	Kishida Chemical	CoO : KB : PVdF = 80 : 10 : 10		
Co ^{2+/3+} (Co ₃ O ₄)	>99.95%, Kanto Chemical	Co ₃ O ₄ : KB : PVdF = 80 : 10 : 10		
Co ³⁺ (LiCoO ₂)	Nippon Chemical Industrial	LiCoO ₂ : AB : PVdF = 80 : 10 : 10		
Ni ²⁺ (NiO)	>99.0%, Wako Chemical	NiO :KB : PVdF = 80 : 10 : 10		
Ni ³⁺ (Ni ₂ O ₃)	TCI	Ni ₂ O ₃ : AB : PVA = 80 : 10 : 10		

NMC111: LiNi_{1/3}Mn_{1/3}Co_{1/3}O₂, HC: Hard carbon, KB: Ketjen Black, PVdF: Polyvinylidene difluoride, AB: Acetylene black, PVA: polyvinyl alcohol (Wako Chemical, DP=3500), PTFE: polytetrafluoroethylene (F-104, Daikin), PANa: Sodium Polyacrylate, SBR: Styrene-butadiene rubber, CMC: Sodium carboxymethyl cellulose, LiFSA: Lithium bis(fluorosulfonyl)amide, LiTFSA: Lithium bis(trifluoromethanesulfonyl)amide, NaTFSA: Sodium bis(trifluoromethanesulfonyl)amide, KTFSA: Potassium bis(trifluoromethanesulfonyl)amide

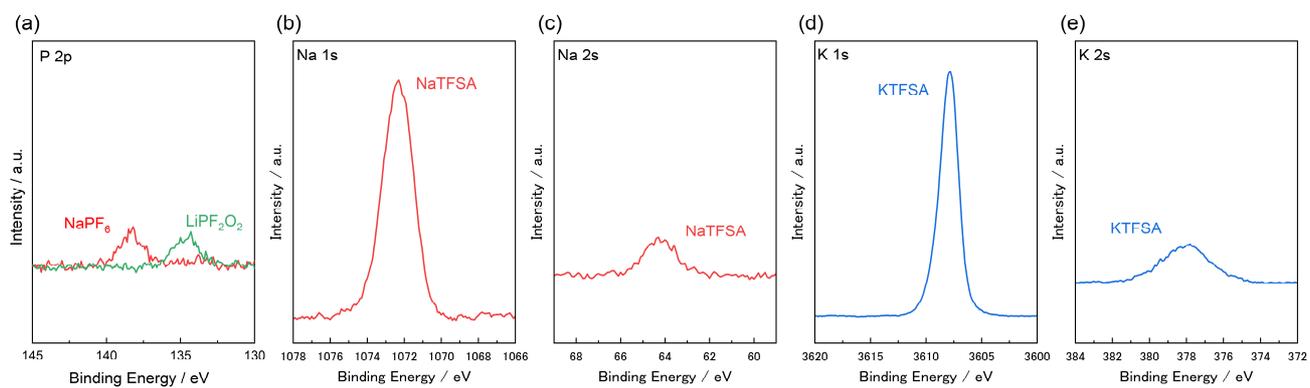


Figure S1 (a) P 2p spectra of NaPF₆ and LiPF₂O₂. (b) Na 1s, and (c) Na 2s spectra of NaTFSA. (d) K 1s and (e) K 2s spectra of KTFSA.