

The production and electrochemical performance analysis of O3-NaTi_{0.2}Mn_{0.2}Fe_{0.2}Ni_{0.2}Co_{0.2}O₂ High entropy oxide cathode for Na-ion battery

Ali Topal¹, Abdul Naveed^{1,2}, Crispin Hetherington³, Rachel Gouttebaron⁴, Sevda Sahinbay^{5*}, Serdar Altin^{1,6*}

¹Physics Department, Inonu University, Battalgazi, Malatya 44280, Türkiye

²Department of Chemistry, Quaid-i-Azam University, Islamabad 45320, Pakistan.

³Centre for Analysis and Synthesis, Department of Chemistry, Lund University, 221 00 Lund, Sweden

⁴Synthesis, irradiation & analysis of materials (SIAM) technological platform, University of Namur, Rue de Bruxelles 61, Namur 5000, Belgium

⁵Physics Engineering Department, Istanbul Technical University, Istanbul 34467, Türkiye

⁶Battery Technology Application and Research Center, Inonu University, Battalgazi, Malatya 44280, Türkiye

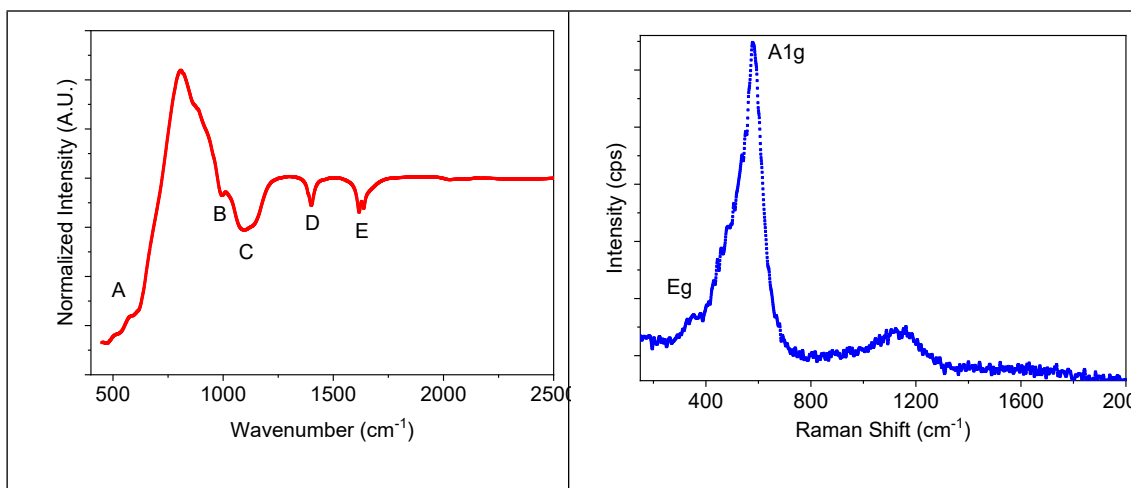


Figure S1. FTIR and Raman analysis of HEO powders

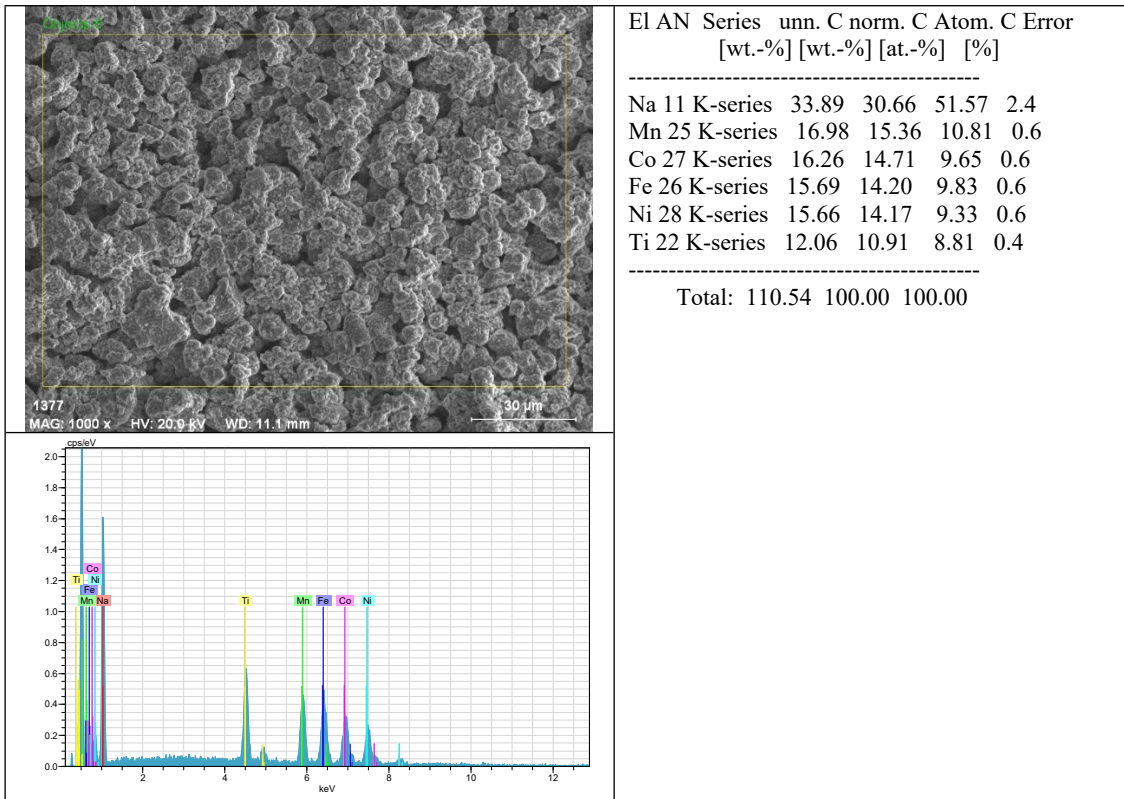


Figure S2. EDX dot mapping analysis results of HEO powders

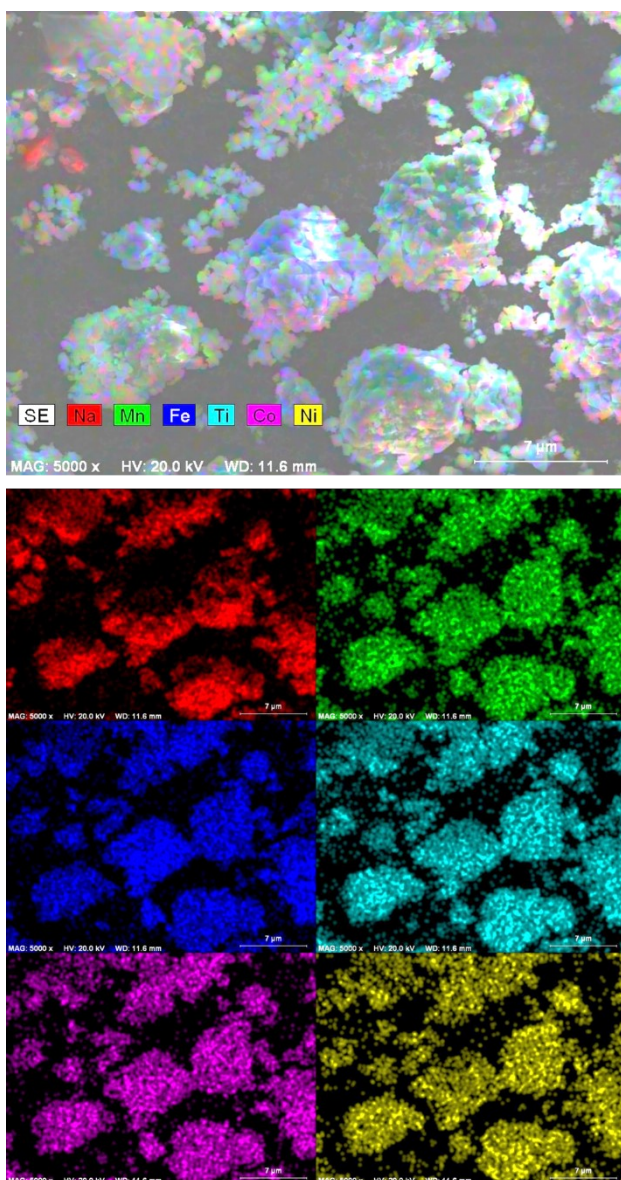


Figure S3. Elemental mapping

Table S1. XPS analysis of the HEO sample

Element	Oxidation	Peaks	area	%
Co	+2	2p _{3/2}	2456.17	47.83
	+3	2p _{3/2}	2679.16	52.17
	+2	2p _{1/2}	1230.24	47.83
	+3	2p _{1/2}	1342.03	52.17
Fe	+2	2p _{3/2}	4149.01	73.97
	+3	2p _{3/2}	1460.03	26.03
	+2	2p _{1/2}	2076.76	73.97
	+3	2p _{1/2}	730.96	26.03

Ni	+2	2p _{3/2}	2908.93	70.25
	+3	2p _{3/2}	1232.06	29.75
	+2	2p _{1/2}	1458.56	70.24
	+3	2p _{1/2}	617.85	29.76

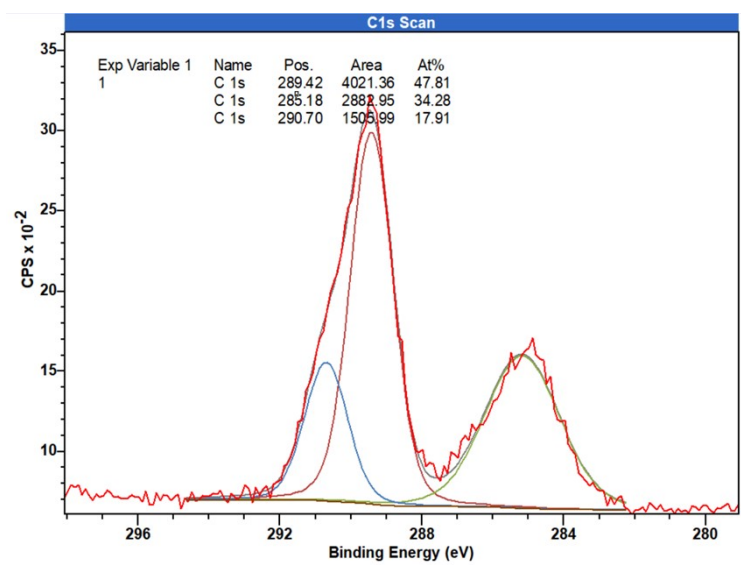


Figure S5. C1s XPS spectrum of the sample

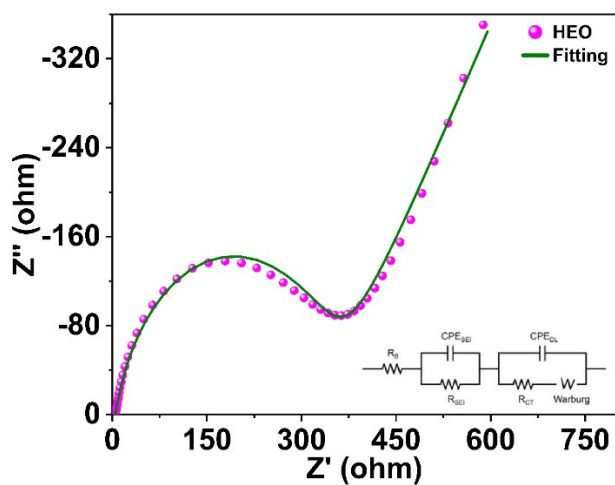


Figure S4. EIS of HEO half cell with the equivalent circuit model in the inset.

Table S2. EIS model analysis result

<i>Parameter</i>	<i>Value</i>
Rs	7.70E+00
R1	8.77E+02
Qy1	1.20E-05
Qa1	8.70E-01
R2	5.07E-12
W	1.14E-03
Qy2	2.01E-04
Qa2	1.53E+00