

Supplemental information

Electronic transport properties in lithium cobalt oxide battery electrode material studied in ion-gated transistor configuration

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SUPPLEMENTAL INFORMATION

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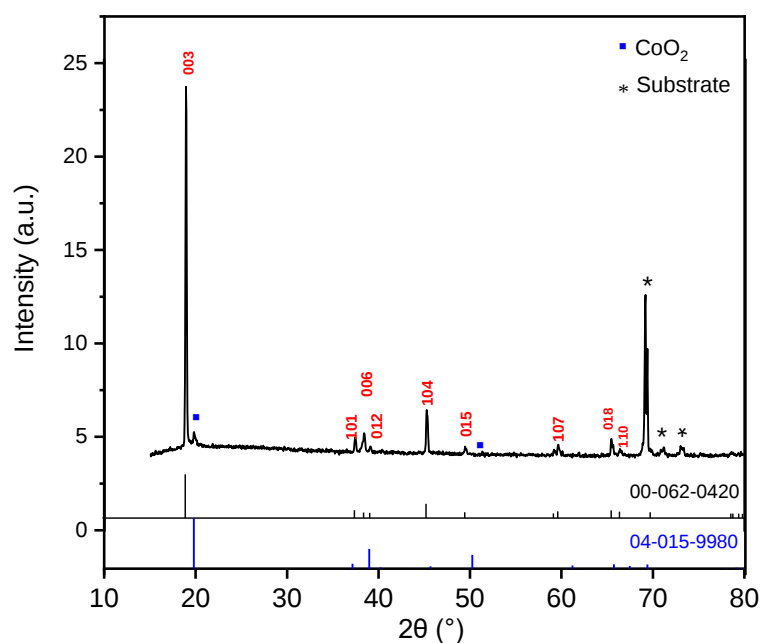


Figure S1. XRD pattern of LCO composite deposited on SiO₂/Si substrate. JCPDS 00-062-0420 corresponds to LCO hexagonal phase. JCPDS 04-015-9980 corresponds to CoO₂.

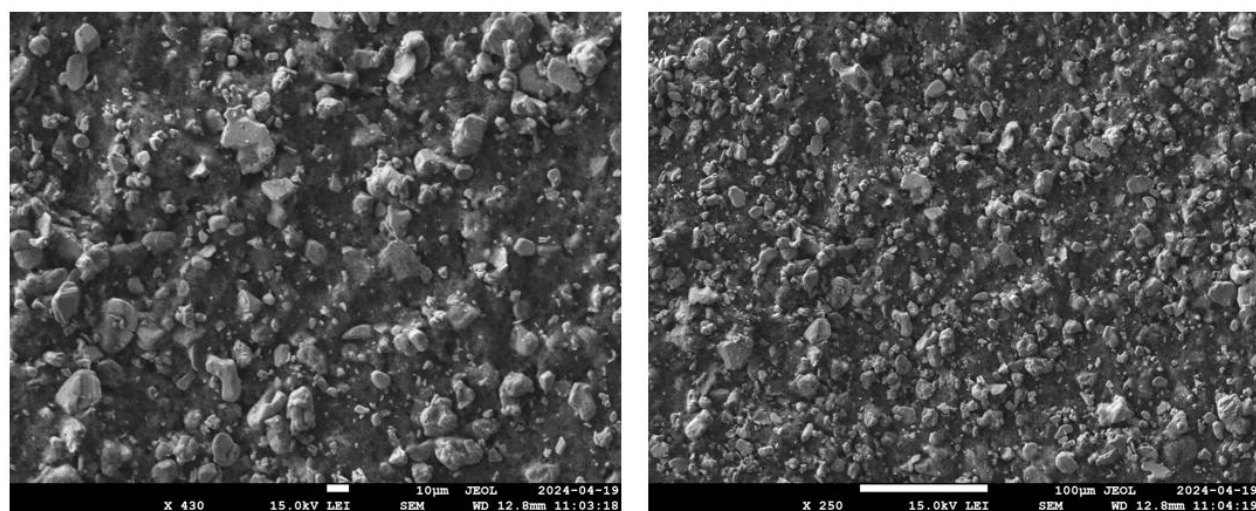


Figure S2. SEM images of LCO composite deposited on SiO₂/Si substrate at different magnifications, acquired at an accelerating voltage of 15 kV.

In Figure S2, at higher magnification (left), the SEM image reveals individual LCO particles with irregular shapes, embedded in a matrix whereas at lower magnification (right), it illustrates the homogeneous distribution of the particles on the substrate.

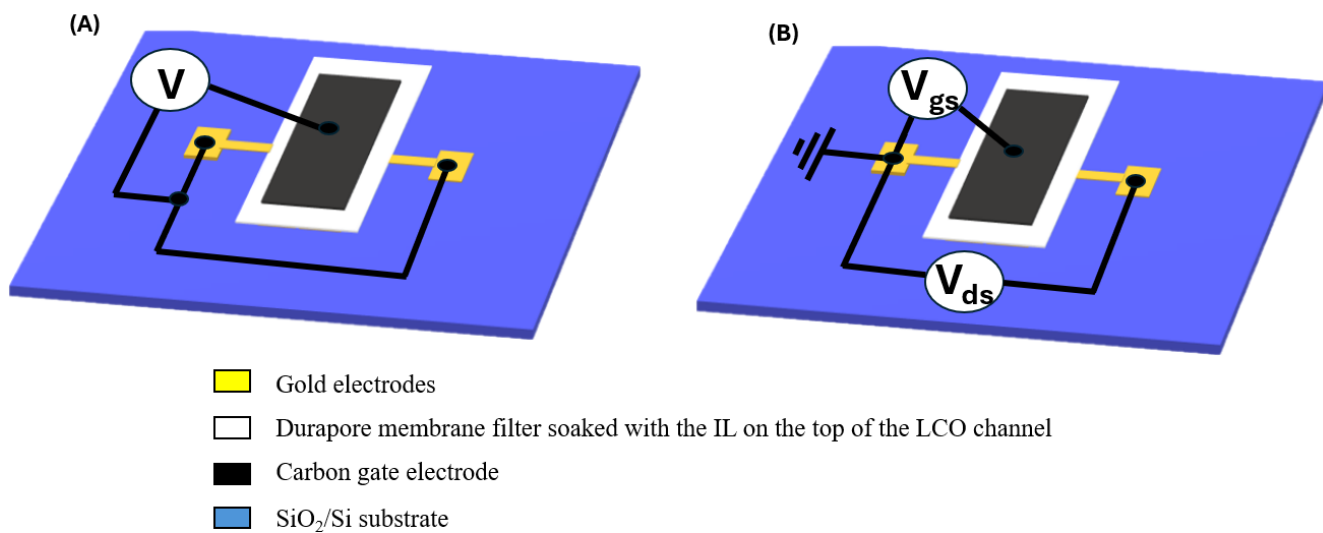


Figure S3. IGT configuration for: (A) Cyclic voltammetry characterization and (B) Transistor characterization. V_{gs} is the gate-source bias, V_{ds} is the drain-source bias, V indicates the electrochemical potential. IL indicates ionic liquid. LCO is Lithium Cobalt Oxide.

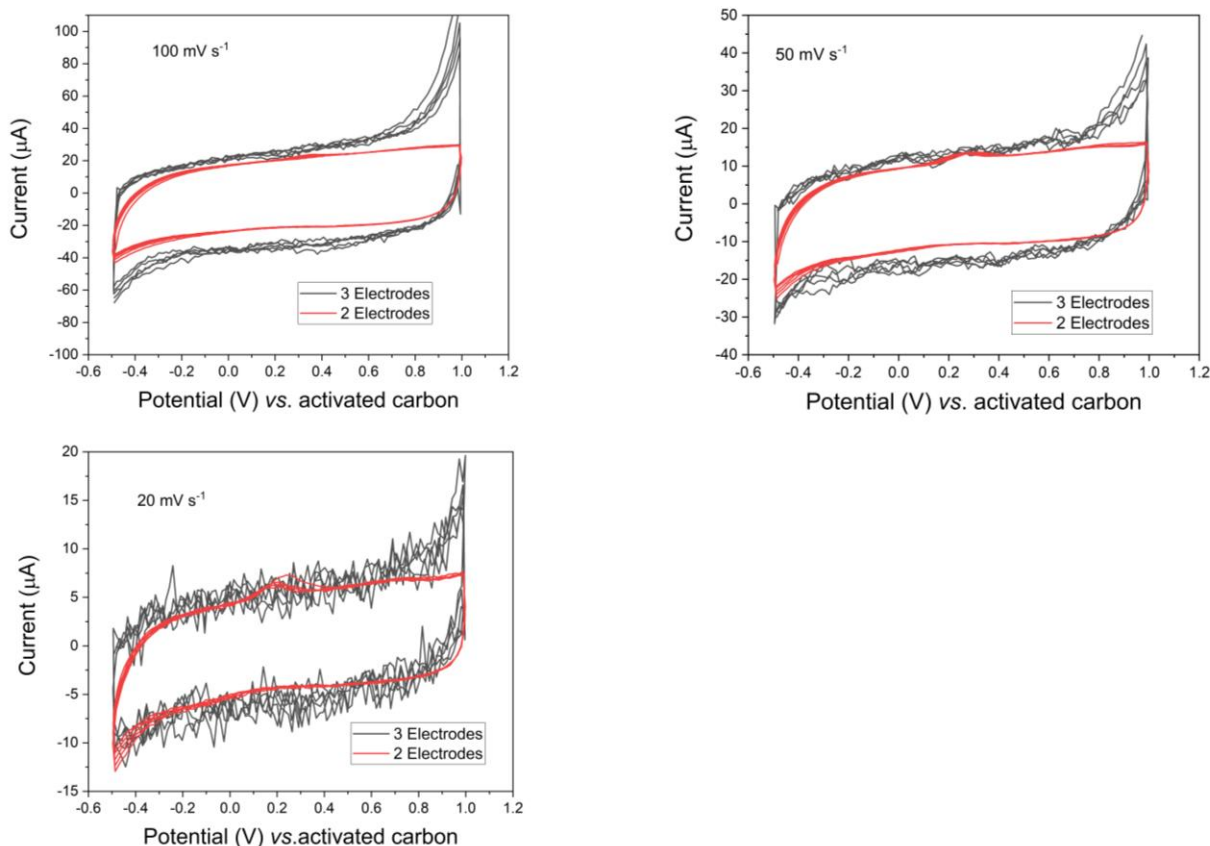


Figure S4. Cyclic voltammograms of the LCO composite in three- and two- electrodes configuration at three different scan rates. Ion-gating medium: [EMIM] [TFSI].

Figure S4 shows the CV curves in three-and two-electrodes configuration. Herein, the carbon gate (5 mm x 3 mm) acts as a counter electrode, a small gate (3 mm x 3 mm) acts as reference electrode and the LCO-based composite transistor channel acts as a working electrode, in the three-electrode configuration. In the two-electrode configuration, the carbon gate (5 mm x 3 mm) acts both as reference and counter electrode and the LCO-based composite transistor channel acts as working electrode.

Table S1. The ON/OFF current ratios of LCO composite-based IGTs calculated from the transfer characteristics.

		5 mV s ⁻¹	20 mV s ⁻¹	100 mV s ⁻¹	Ion-gating medium
	V_{gs} (V)	I_{ds} (mA)	I_{ds} (mA)	I_{ds} (mA)	[EMIM][TFSI]
OFF	0.20	9.26	9.28	9.29	
ON	-1.20	9.42	9.41	9.41	
ON/OFF		1.01	1.01	1.01	
OFF	0.30	9.08	9.09	9.09	[EMIM][TFSI] with Li ⁺
ON	-1.20	9.27	9.25	9.22	
ON/OFF		1.02	1.02	1.02	

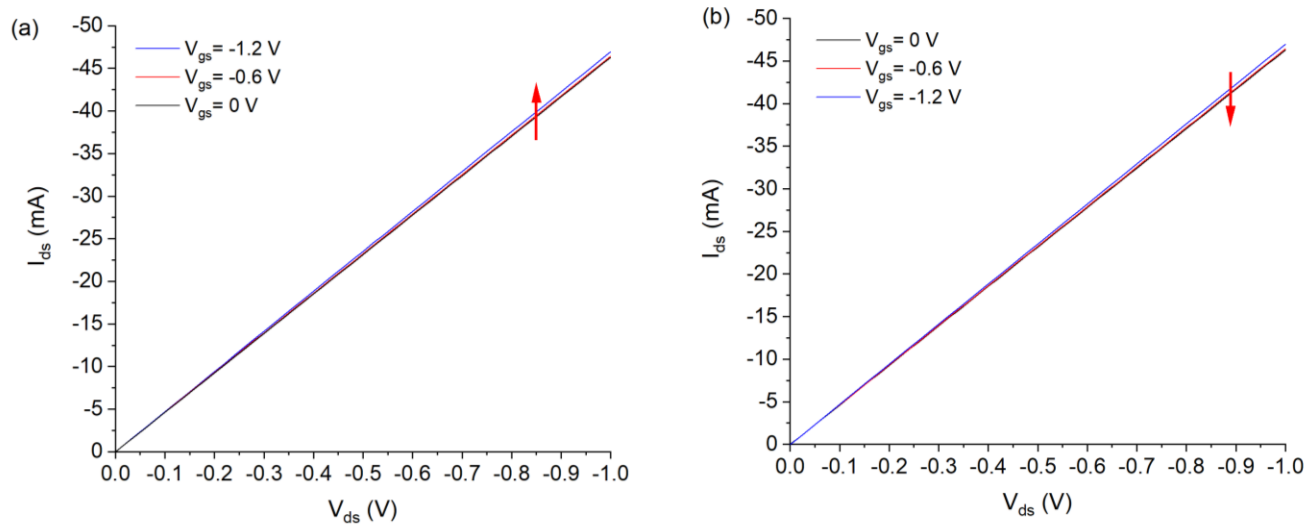


Figure S5. Output characteristics of LCO composite at V_{ds} sweep rate of 20 mV s⁻¹. (a) Forward scan with V_{gs} from 0 V to -1.2 V. (b) Reverse scan with V_{gs} from -1.2 V to 0 V. Ion-gating medium: [EMIM][TFSI].

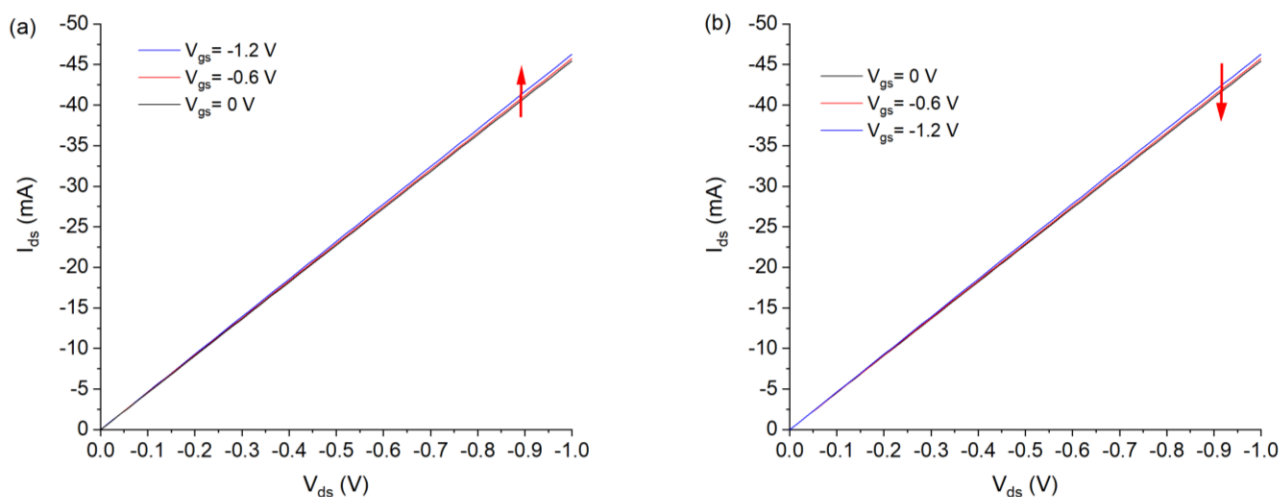


Figure S6. Output characteristics of LCO composite at V_{ds} sweep rate of 20 mV s^{-1} . (a) Forward scan with V_{gs} from 0 V to -1.2 V. (b) Reverse scan with V_{gs} from -1.2 V to 0 V Ion-gating medium: 0.1 M LiTFSI in [EMIM][TFSI].

Table S2. Resistances (R) for LCO-based composite deduced from the output characteristics during the forward and reverse scans at sweep rate of 20 mV s^{-1} . V_{gs} from 0 V to -1.2 V (-0.6 V steps). [EMIM] [TFSI] ion-gating medium.

	Forward scan	Reverse scan
V_{gs} (V)	R (Ω)	R (Ω)
0 (3 V vs. Li^+/Li)	21.58	21.58
-0.6 (3.6 V vs. Li^+/Li)	21.51	21.52
-1.2 (4.2 V vs. Li^+/Li)	21.28	21.29

Table S3. Resistance (R) for LCO-based composite deduced from the output characteristics during the forward and reverse scans at V_{ds} sweep rate of 20 mV s^{-1} . V_{gs} from 0 V to -1.2 V (-0.6 V steps). 0.1 M LiTFSI in [EMIM] [TFSI] ion-gating medium.

	Forward scan	Reverse scan
V_{gs} (V)	R (Ω)	R (Ω)
0 (3 V vs. Li^+/Li)	22.00	22.00
-0.6 (3.6 V vs. Li^+/Li)	21.84	21.86
-1.2 (4.2 V vs. Li^+/Li)	21.58	21.60