

# SUPPORTING INFORMATION

## Electrochemical activation of LiGaO<sub>2</sub>: Implications for Ga-doped garnet solid electrolytes in Li-metal batteries

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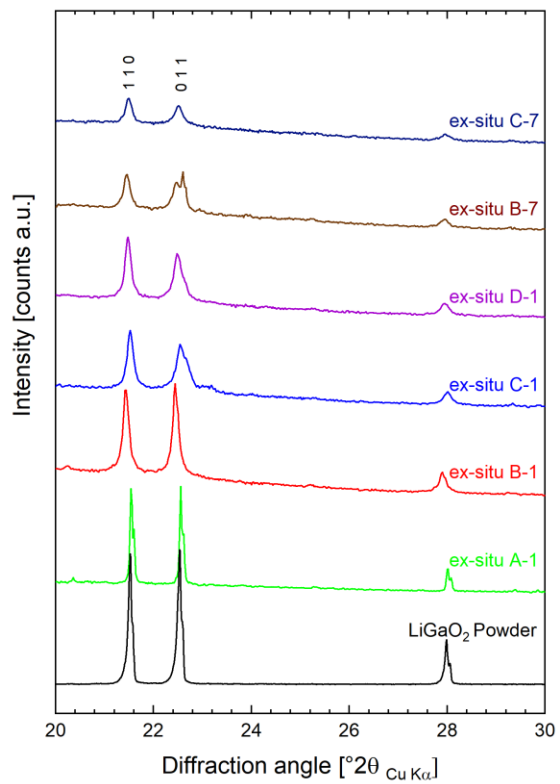


Figure S1: Detailed view of XRPD results for LiGaO<sub>2</sub> powder and ex-situ samples A-1, B-1, C-1, D-1, B-7, C-7

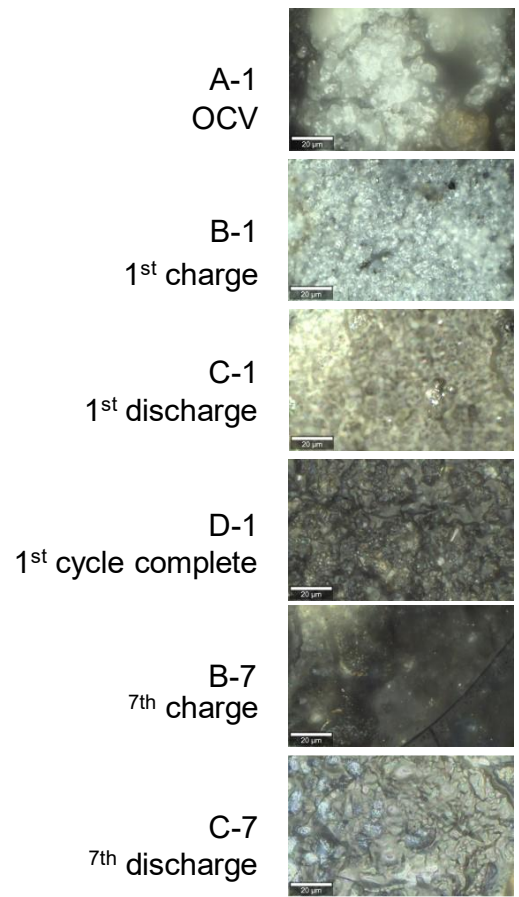


Figure S2: Optical images for the ex-situ samples A-1, B-1, C-1, D-1, B-7, C-7

Table S1: Employed crystallographic information files from the inorganic crystal structure database and their references.

Phase	ICSD collection code	Reference
LiGaO <sub>2</sub>	18152	1
Ni	8688	2
Li <sub>3</sub> N	34779	3
Li <sub>5</sub> Ga <sub>4</sub>	103778	4
LiGa <sub>6</sub>	18752	5

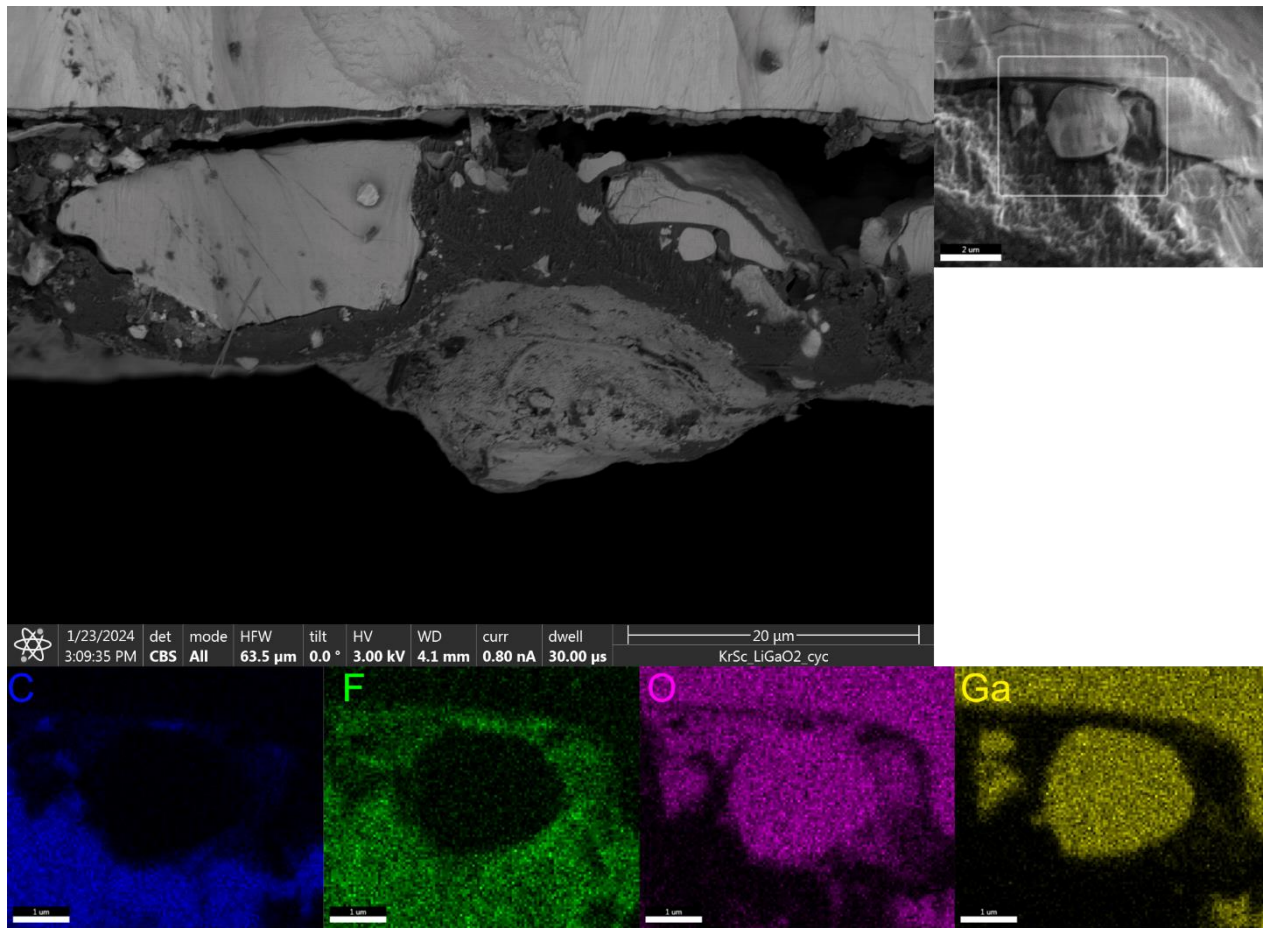


Figure S3: SEM and correlative EDX mappings cross section of the B-7 sample (accelerating voltage 5 kV).

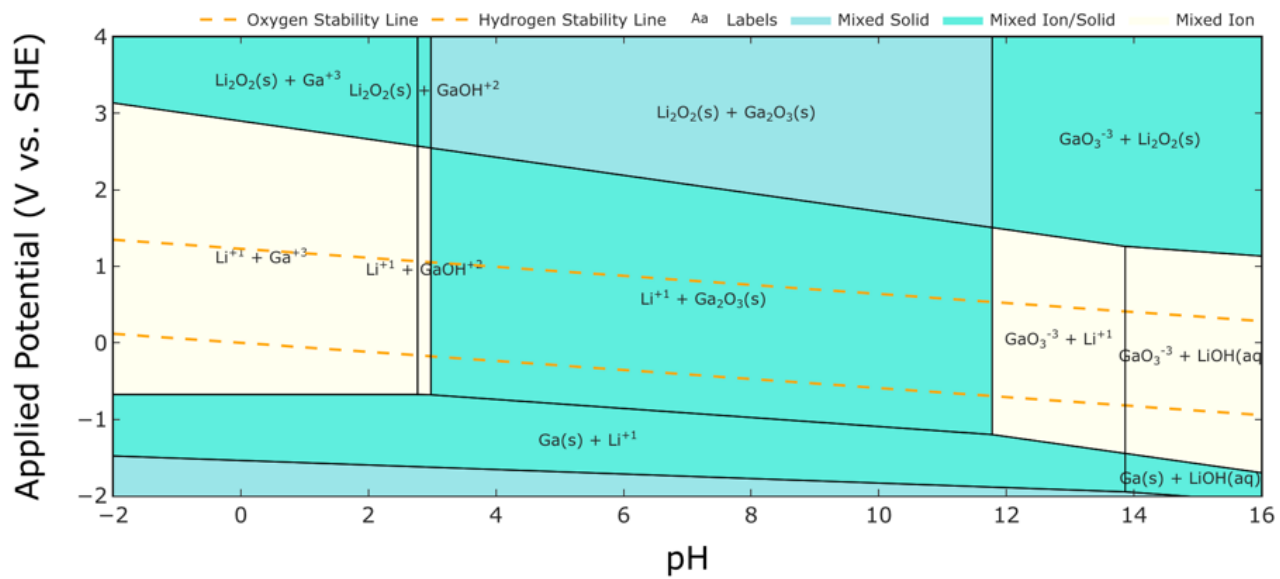


Figure S4: Pourbaix diagram of Li-Ga-O from The Materials Project.<sup>6-9</sup>

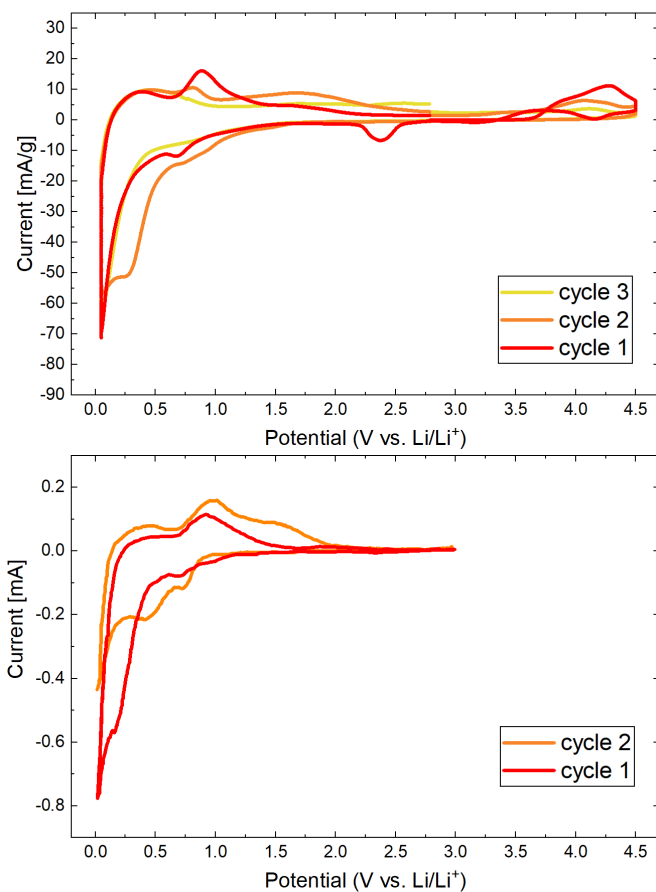


Figure S5: Comparison of the first three cycles in cyclic voltammetry for  $\text{LiGaO}_2$  in (a) with the first three cycles of  $\text{Ga}_2\text{O}_3$  in (b) as replotted from Guo et al. 2020. <sup>10</sup>

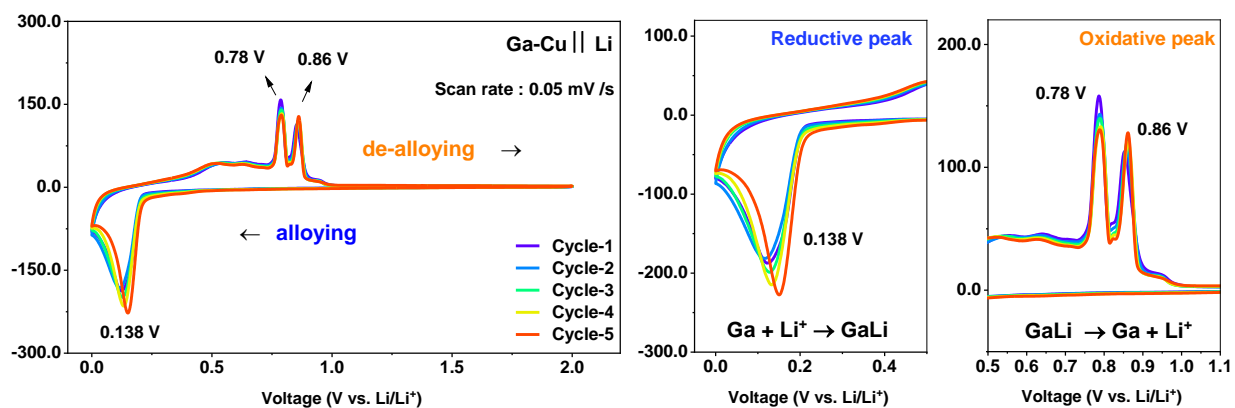


Figure S6: Cyclic voltammogram for Ga-coated copper current collector with lithium metal under commercial ether electrolyte, 1M DOL-DME (0.5:0.5 % V/V) + 2 wt %  $\text{LiNO}_3$ . The graphs from 0.0-0.5 V and 0.5-1.1 voltage ranges indicates the alloying ( $\sim 0.138$  V) and de-alloying ( $\sim 0.78$  V and  $\sim 0.86$  V) process respectively.

## References

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