

# Low-temperature Aged Synthesis of CeO<sub>2</sub>-coated Li-rich Oxide as Cathode for Low Cost High Energy Density Li-ion Batteries

Yanlin Liu <sup>1,3,4</sup>, Bin Li <sup>2</sup>, Min Chen <sup>2,3</sup>, and Weishan Li <sup>2,3,\*</sup>

<sup>1</sup> School of Automobile and Transportation Engineering, Guangdong Polytechnic Normal University, Guangzhou 510450, China

<sup>2</sup> School of chemistry, South China Normal University, Guangzhou 510006, China

<sup>3</sup> National and Local Joint Engineering Research Center of MPTEs in High Energy and Safety LIBs, Engineering Research Center of MTEES (Ministry of Education), and Key Lab. of ETESPG(GHEI), South China Normal University, Guangzhou 510006, China

<sup>4</sup> School of Material and Energy, Guangdong University of Technology, Guangzhou 510006, Guangdong, China

\* Correspondence: liwsh@scnu.edu.cn (W. Li); Tel. +8602039310256.

## Figures and Tables:

Fig. S1. TEM image (A) and corresponding EDS elemental mapping of Ce (B), TEM image (C) and selected area electron diffraction (SAED) of CeO<sub>2</sub> (D) for CeO<sub>2</sub> coated Li<sub>1.2</sub>Ni<sub>0.2</sub>Mn<sub>0.6</sub>O<sub>2</sub> without the low-temperature-aged coating process.

Fig. S2. XPS of the cycled LMN-P and LMN-C electrode.

Table S1. EDS of lithium electrodes from the cycled cells with LMN-P and LMN-C.

Table S2. ICP analysis for Mn and Ni of the lithium electrodes from the cycled cells with LMN-P and LMN-C.

**Citation:** To be added by editorial staff during production.

Academic Editor: Firstname Last-name

Received: date

Revised: date

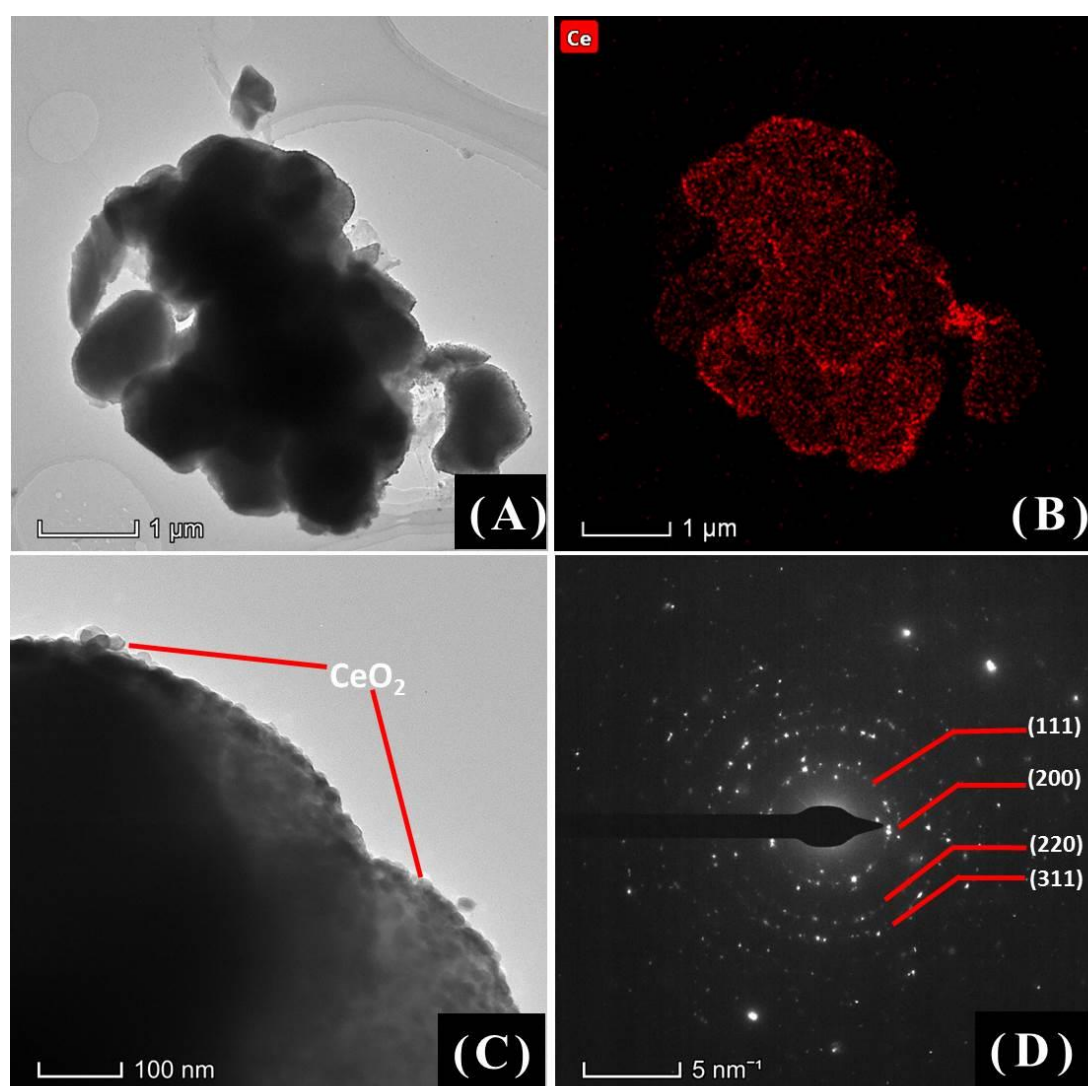
Accepted: date

Published: date



**Copyright:** © 2023 by the authors.

Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).



**Fig. S1.** TEM image (A) and corresponding EDS Ce mapping of (B), TEM image (C) and selected area electron diffraction (SAED) of  $\text{CeO}_2$  (D) for  $\text{CeO}_2$  coated  $\text{Li}_{1.2}\text{Ni}_{0.2}\text{Mn}_{0.6}\text{O}_2$  without the low-temperature-aged coating process.

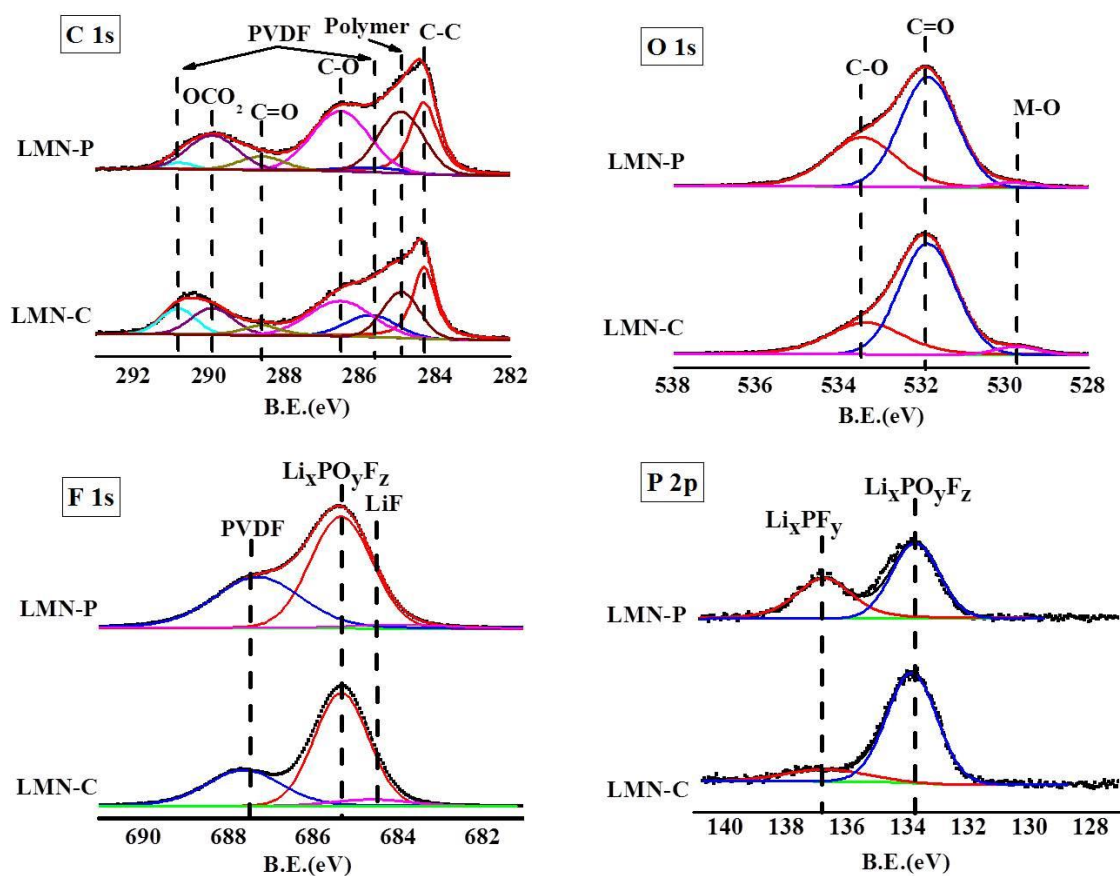


Fig. S2. XPS patterns of the cycled LMN-P and LMN-C electrode.

**Table S1.** EDS element contents on the lithium electrodes from the cycled cells with LMN-P and LMN-C.

		<b>C</b>	<b>O</b>	<b>F</b>	<b>P</b>	<b>Mn</b>	<b>sum</b>
		<b>(%)</b>	<b>(%)</b>	<b>(%)</b>	<b>(%)</b>	<b>(%)</b>	<b>(%)</b>
<b>LMN-P</b>	<b>Sample 1</b>	21.88	45.26	25.20	6.53	1.13	100.00
	<b>Sample 2</b>	21.93	44.01	26.02	6.92	1.12	100.00
	<b>Sample 3</b>	21.89	44.62	25.69	6.67	1.13	100.00
	<b>Average</b>	21.90	44.63	25.64	6.71	1.13	100.00
<b>LMN-C</b>	<b>Sample 1</b>	11.38	38.94	45.59	3.89	0.20	100.00
	<b>Sample 2</b>	13.06	42.82	39.94	3.86	0.32	100.00
	<b>Sample 3</b>	11.51	43.48	40.64	3.99	0.38	100.00
	<b>Average</b>	11.98	41.75	42.06	3.91	0.30	100.00

**Table S2.** ICP element contents on the lithium electrodes from the cycled cells with LMN-P and LMN-C.

	% Mn detected on Li	% Ni detected on Li
Li anode from LMN-P	3.87	1.93
Li anode from LMN-C	0.65	0.14
Fresh Li	0.00	0.00