

## Supporting Information

### Application of modified styrene-acrylic-rubber-based latex binder to LiCoO<sub>2</sub> composite electrodes for lithium-ion batteries

Lu YIN,<sup>a,§</sup> Ryoichi TATARA,<sup>a,§§</sup> Shogo YAMAZAKI,<sup>a</sup> Rena TAKAISHI,<sup>b</sup> Eisuke SHIYAMA,<sup>b</sup> Takashi MATSUYAMA,<sup>b</sup> Satoshi YASUNO,<sup>c</sup> and Shinichi KOMABA<sup>a,\*,§§§</sup>

<sup>a</sup> *Department of Applied Chemistry, Tokyo University of Science, 1-3 Kagurazaka, Shinjuku, Tokyo 162-8601, Japan*

<sup>b</sup> *NIPPON A&L INC., 3-1-98 Kasugadenaka, Konohanaku, Osaka, 554-8558, Japan*

<sup>c</sup> *Japan Synchrotron Radiation Research Institute (JASRI), 1-1-1 Kouto, Sayo-gun, Hyogo, 679-5198, Japan*

*§ ECSJ Student Member*

*§§ ECSJ Active Member*

*§§§ ECSJ Fellow*

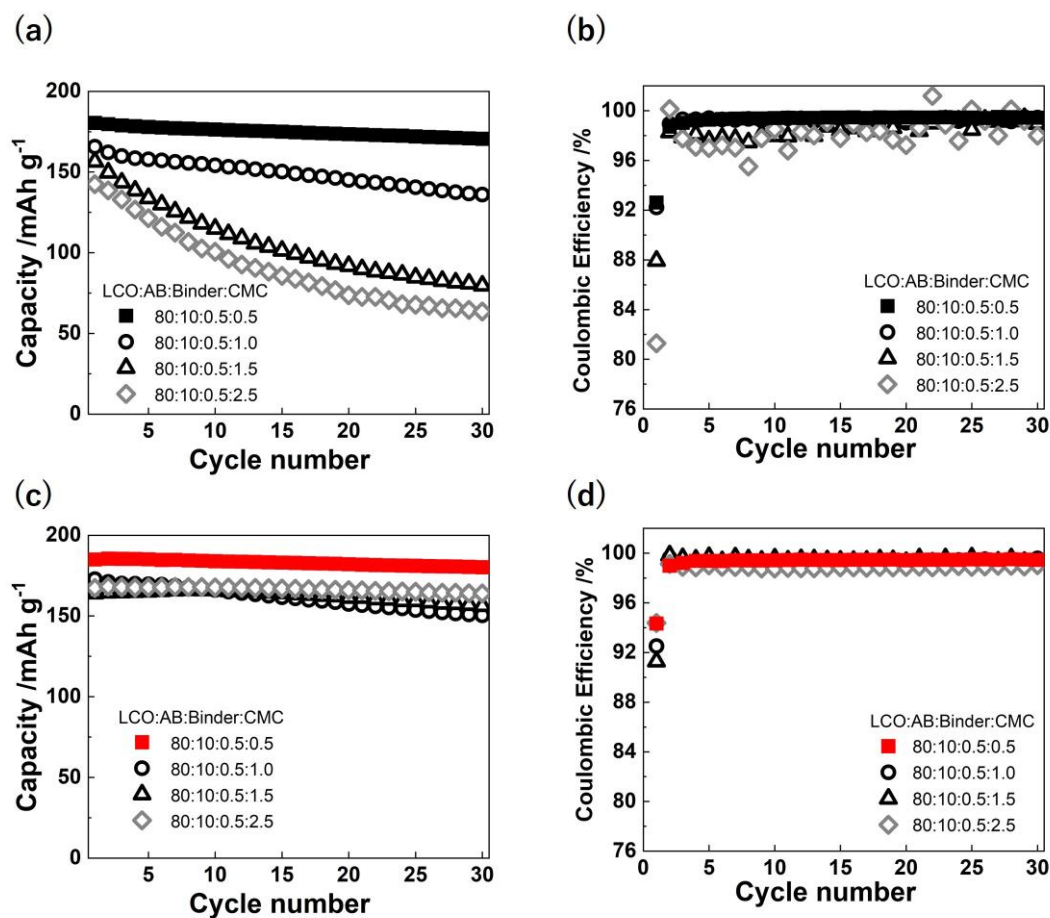
*ORCID:*

*Shinichi KOMABA: 0000-0002-9757-5905*

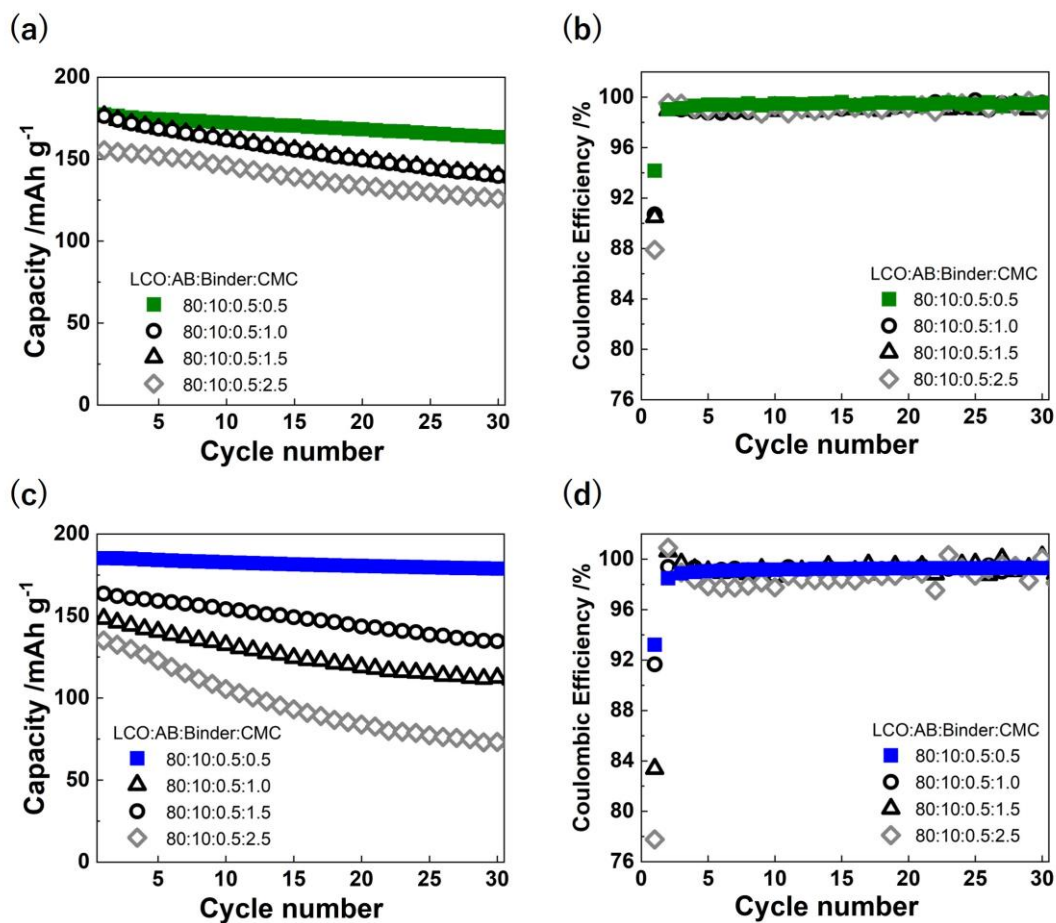
*Ryoichi Tatara: 0000-0002-8148-5294*

*Satoshi YASUNO: 0000-0002-7832-0608*

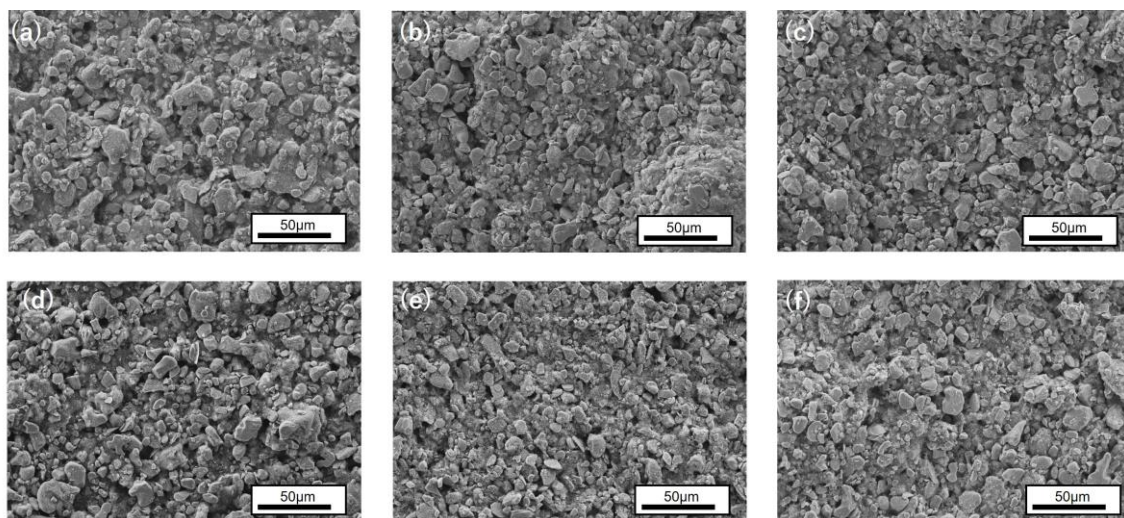
*\*Correspondence to: komaba@rs.tus.ac.jp*



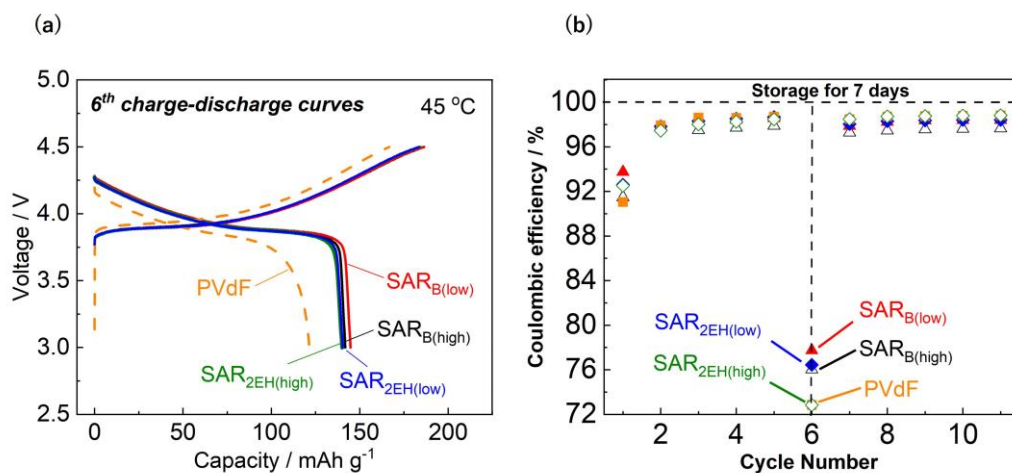
**Figure S1.** Variation in the capacities and Coulombic efficiencies of LiCoO<sub>2</sub>//Li half-cells with (a) and (b) SAR<sub>B(high)</sub>, (c) and (d) SAR<sub>B(low)</sub> binders, respectively, at different binder polymer contents in the composite electrodes. The cells are cycled in the voltage range of 3.0–4.5 V at 25 °C using 1 M LiPF<sub>6</sub> in EC/DMC as an electrolyte.



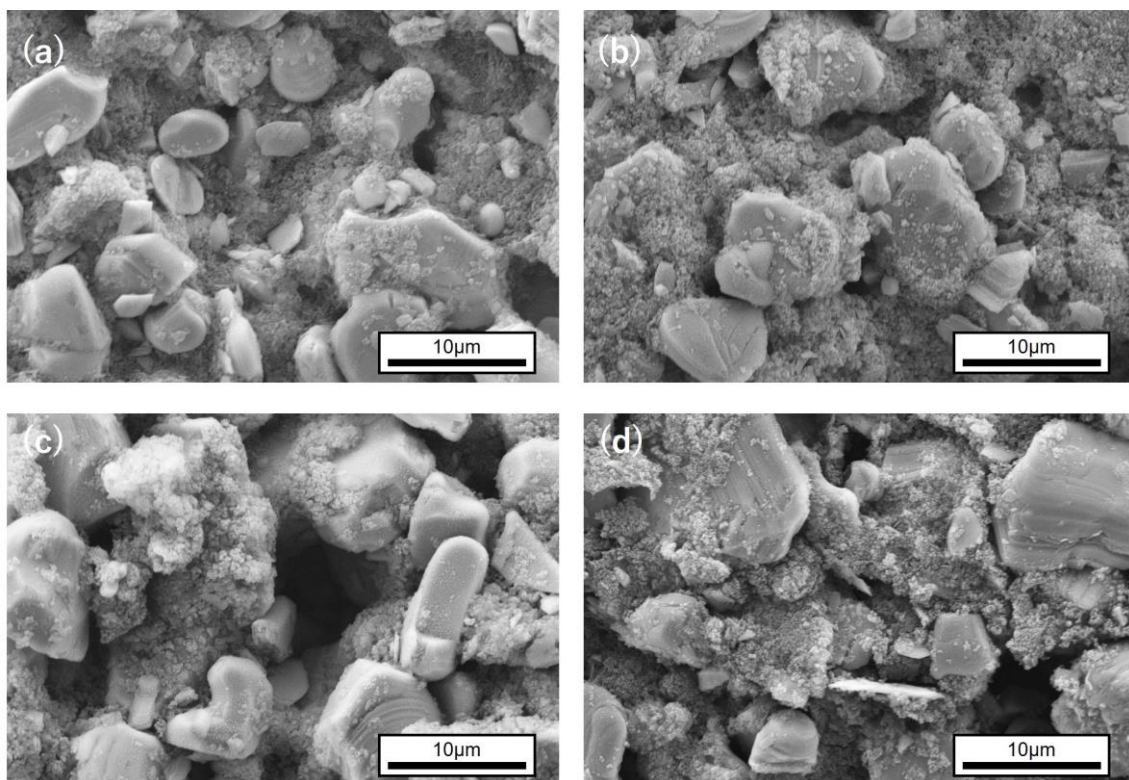
**Figure S2.** Variation in the capacities and Coulombic efficiencies of LiCoO<sub>2</sub>//Li half-cells with (a) and (b) SAR<sub>2</sub>EH<sub>(high)</sub>, (c) and (d) SAR<sub>2</sub>EH<sub>(low)</sub> binders, respectively, at different binder polymer contents in the composite electrodes. The cells are cycled in the voltage range of 3.0–4.5 V at 25 °C using 1 M LiPF<sub>6</sub> in EC/DMC as an electrolyte.



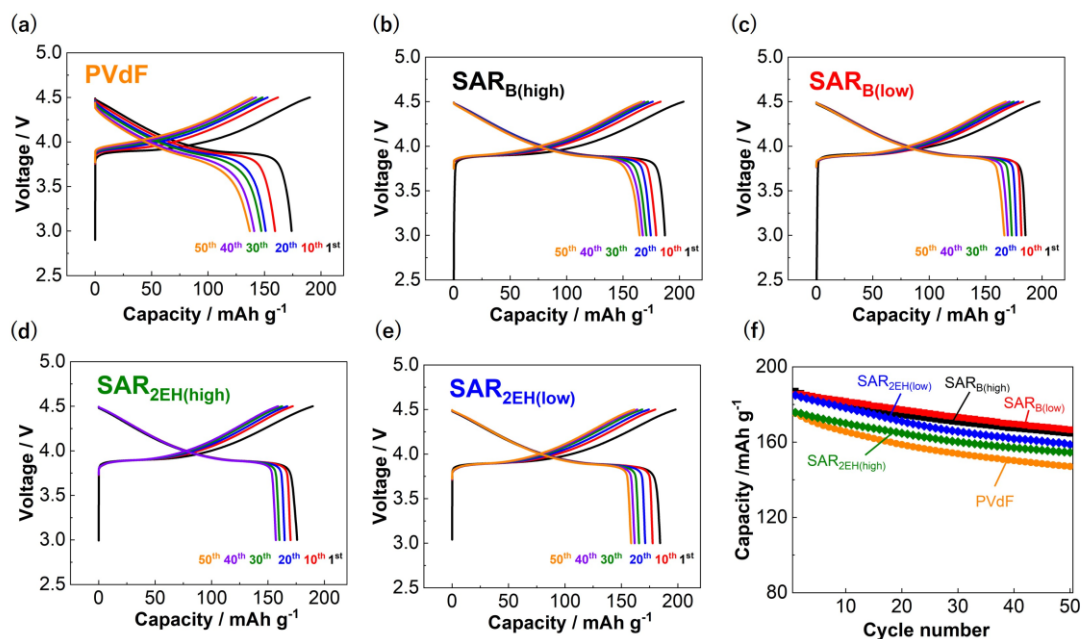
**Figure S3.** The SEM images of the pristine LiCoO<sub>2</sub> electrodes; (a) PVdF, (b) SAR<sub>B</sub>(high), (c) SAR<sub>B</sub>(low), (d) SAR<sub>2EH</sub>(high), (e) SAR<sub>2EH</sub>(low), and (f) SBR<sub>std</sub>.



**Figure S4.** Self-discharge tests of LiCoO<sub>2</sub> electrodes with different binders at 45 °C: (a) charge–discharge curves of the sixth cycle and (b) Coulombic efficiency. The cells are cycled in 1 mol dm<sup>-3</sup> LiPF<sub>6</sub> in EC/DMC at 20 mA g<sup>-1</sup> in the voltage range of 3.0–4.5 V and stored at 45 °C for 7 d after the sixth charging reaction. Cycling is restarted after 7 d of storage.



**Figure S5.** SEM images of LiCoO<sub>2</sub> electrodes: (a) pristine SAR<sub>2EH</sub>(high), (b) pristine SAR<sub>2EH</sub>(low), (c) after 50 cycles SAR<sub>2EH</sub>(high), and (d) after 50 cycles SAR<sub>2EH</sub>(low), cycled at 25 °C.



**Figure S6.** Charge and discharge curves of LiCoO<sub>2</sub>//Li half-cells with: (a) PVdF, (b) SAR<sub>B</sub>(high), (c) SAR<sub>B</sub>(low), (d) SAR<sub>2EH</sub>(high), and (e) SAR<sub>2EH</sub>(low) binders. (f) Variation in capacities of LiCoO<sub>2</sub>//Li half-cells with PVdF and SAR binders. The cells are cycled at 20 mA g<sup>-1</sup> at 45 °C.