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One-step synthesis of multilayered 2D Sn nanodendrites as a high-performance anode material for Na-ion batteries

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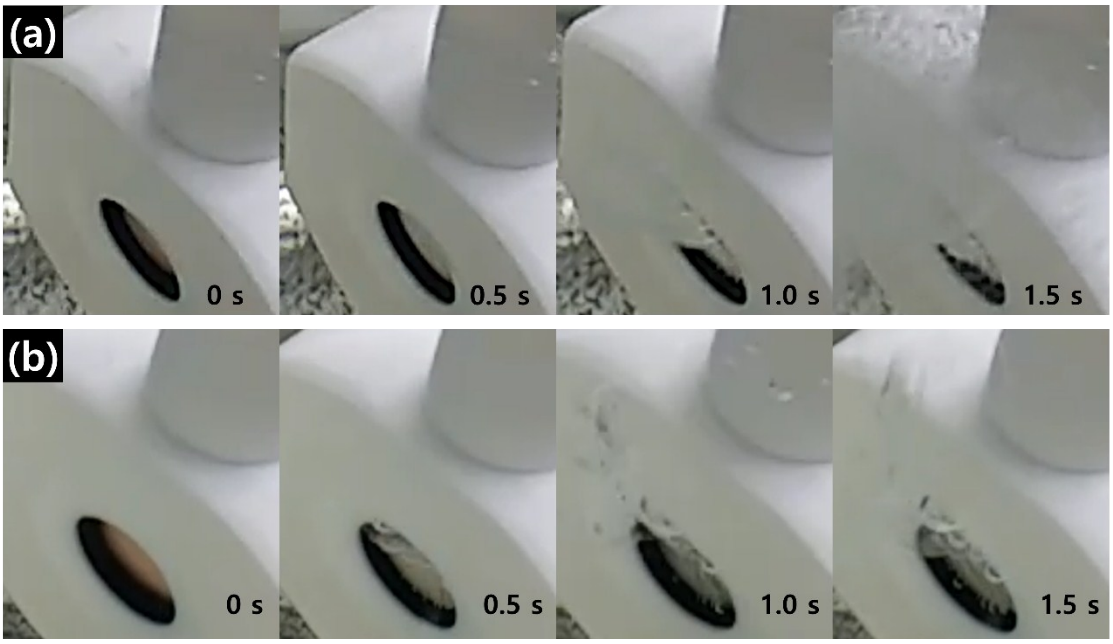

Figure S1. Electrodes surface with time during the electrodeposition processes at -2 A cm^{-2} for 2 s from aqueous solutions containing 0.1 M $SnSO_4$ and 0.7 M H_2SO_4 (a) with and (b) without 0.2 g L^{-1} coumarin.

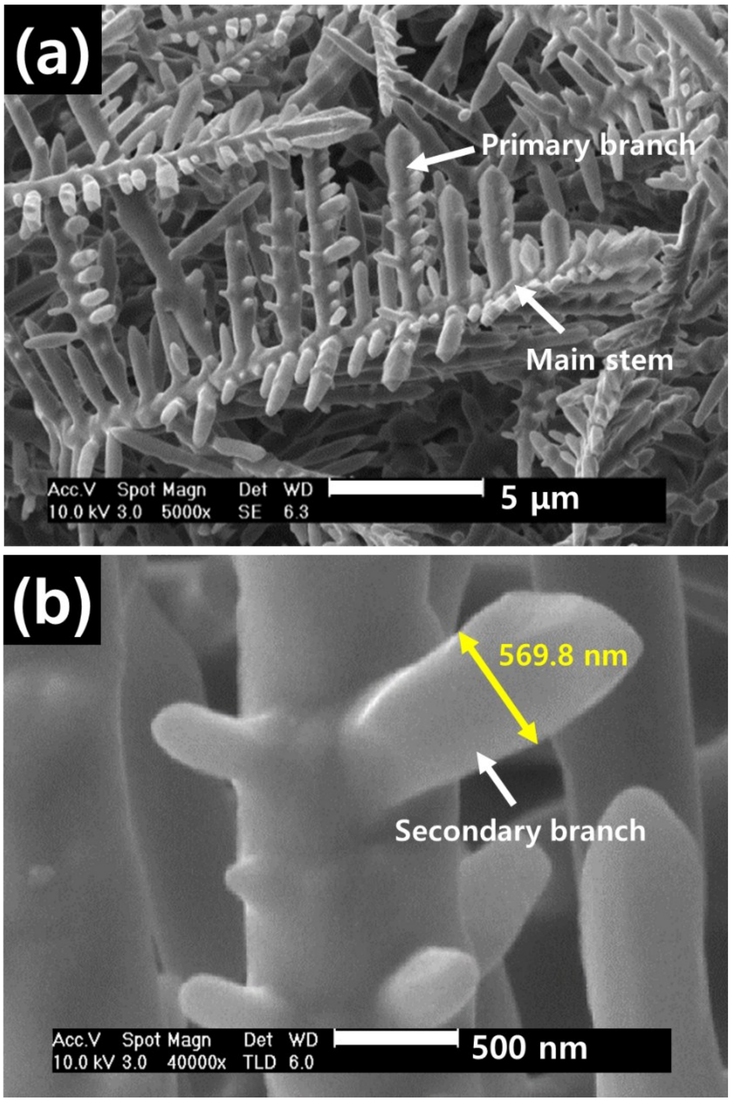

Figure S2. SEM images of the Sn dendrites synthesized by cathodic electrodeposition at -2 A cm^{-2} for 2 s from an aqueous solution containing 0.1 M $SnSO_4$ and 0.7 M H_2SO_4; magnification of (a) 5000x and (b) 40000x.

Figure S3. Pictures of electrode surface with time during electrodeposition process at -2 A cm^{-2} for 2 s from aqueous solutions containing 0.1 M $SnSO_4$ and 0.7 M H_2SO_4, and 120 g L^{-1} aceton.

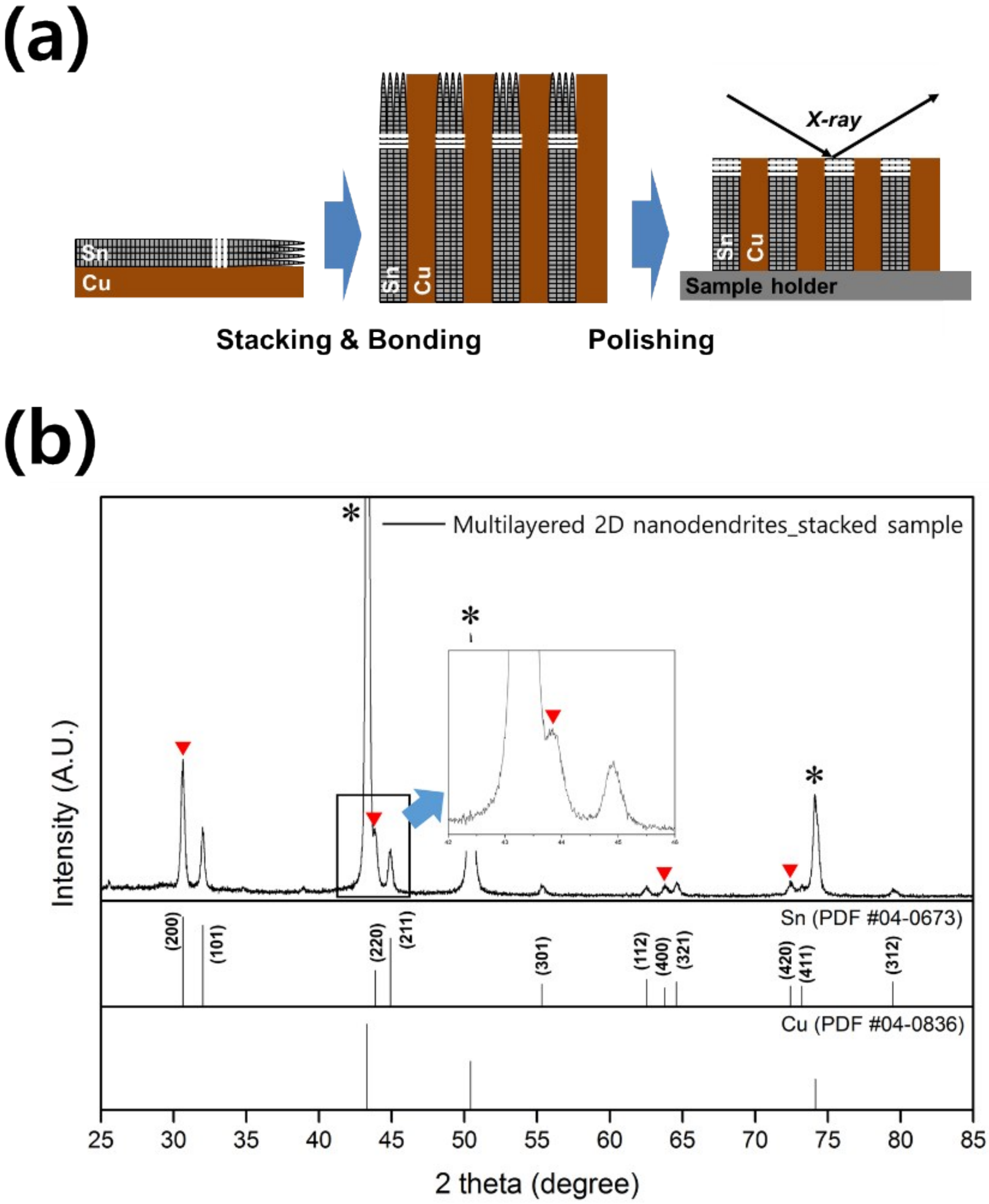

Figure S4. (a) Preparation process of the stacked multilayered 2D Sn nanodendrites electrodes. (b) XRD patterns for the stacked multilayered 2D Sn nanodendrites.

Table S1. Synthesis conditions for the dense Sn layer

Dense Sn Layer Electrodeposition			
Electrolyte	40 g L^{-1} $SnSO_4$ + 150 g L^{-1} H_2SO_4 + 60 g L^{-1} Triton X-100		
Electrolyte Temp.	20 ºC	Agitation	180 rpm
Cathode Electrode	Smooth Cu foil	Anode Electrode	Sn plate
Current density	-10 mA cm^{-2}	Deposition time	1 min

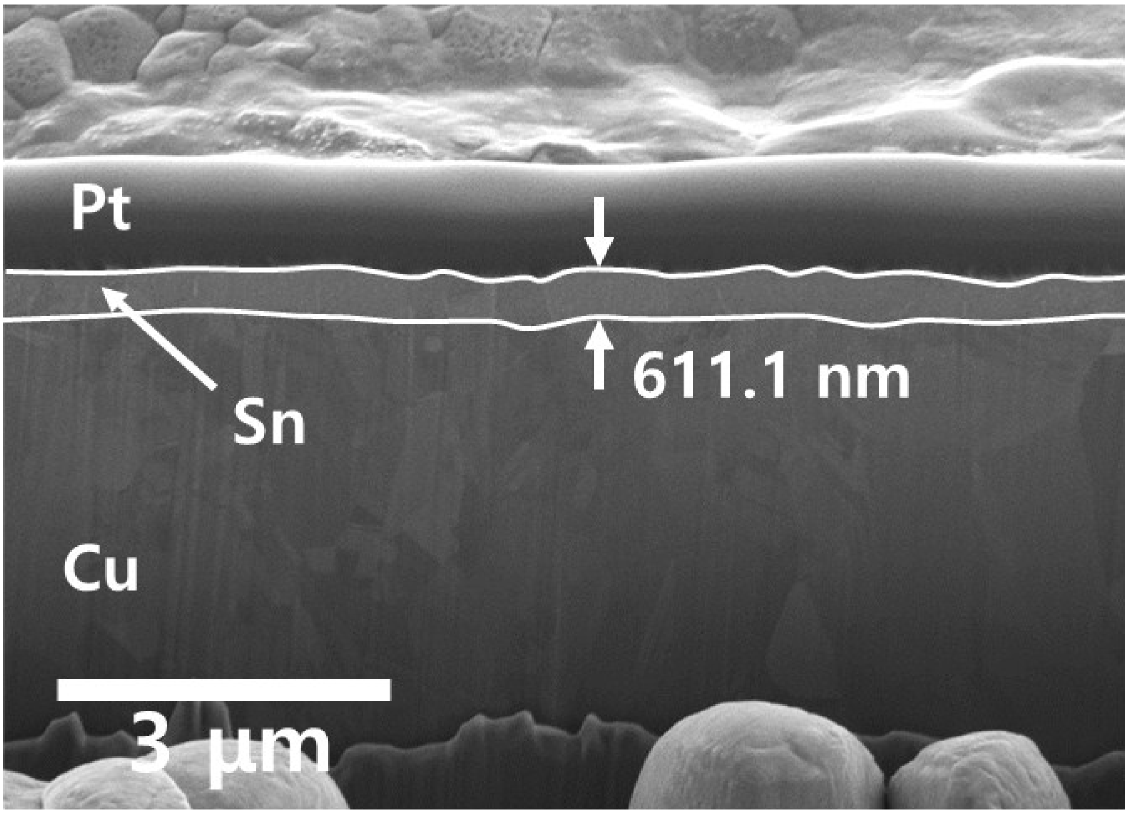

Figure S5. Cross-sectional SEM images of the dense Sn layer synthesized by cathodic electrodeposition at -10 mA cm^{-2} for 1 min from an aqueous solution containing 40 g L^{-1} $SnSO_4$, 150 g L^{-1} H_2SO_4, and 60 g L^{-1} Triton-X 100.

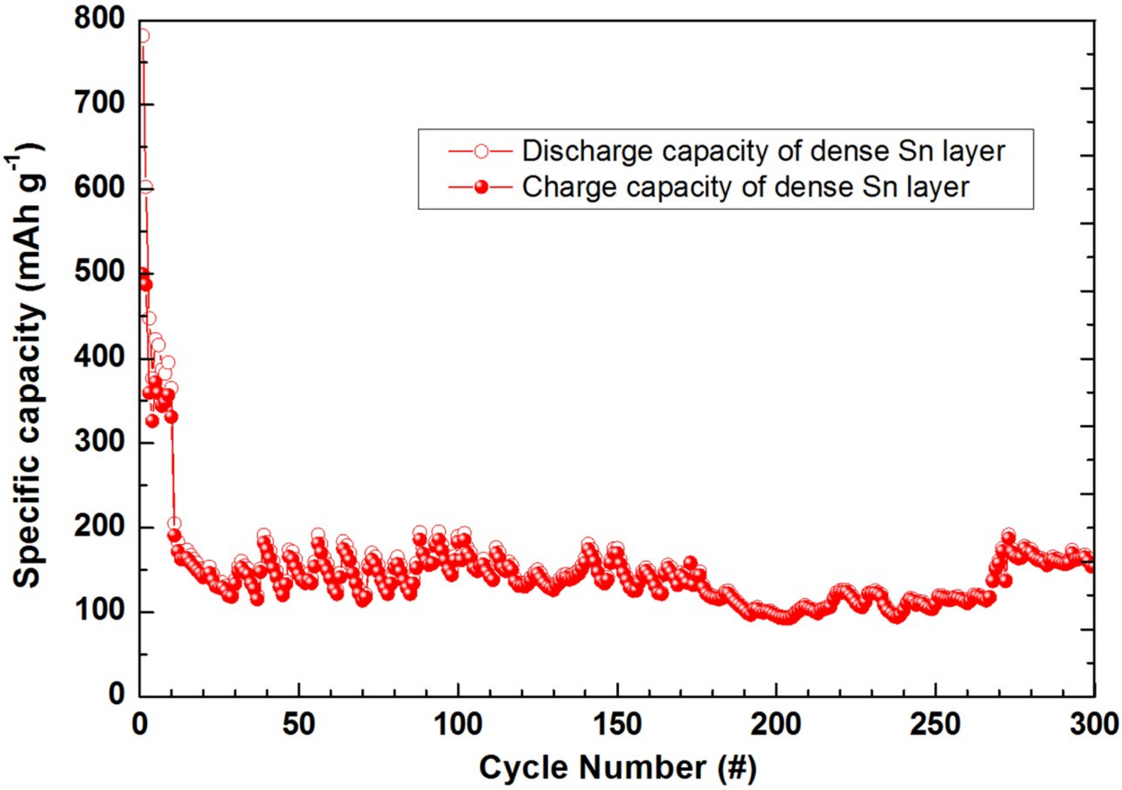

Figure S6. Cycle performance of the dense Sn layer.

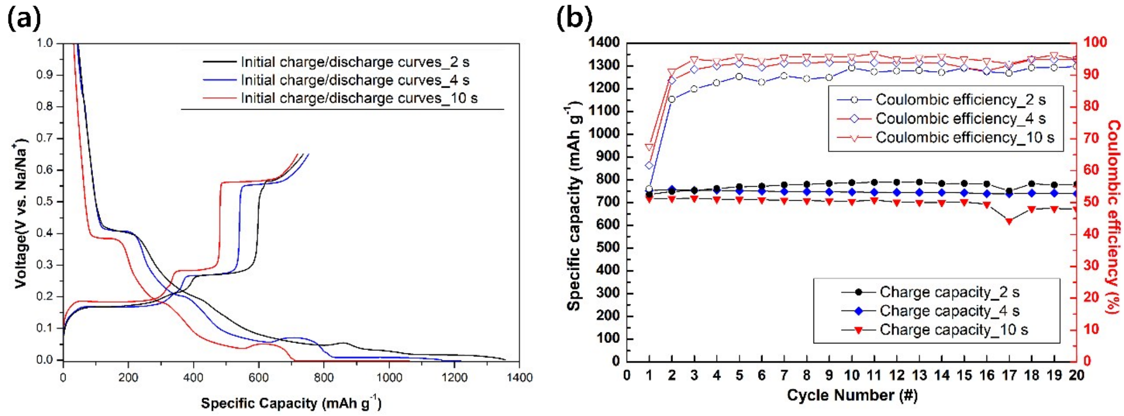

Figure S7. (a) Charge/discharge voltage profiles and (b) cycle performance of the multilayered 2D Sn nanodendrites synthesized by cathodic electrodeposition at -2 A cm^{-2} for 2, 4, and 10 s from an aqueous solution containing 0.1 M $SnSO_4$, 0.7 M H_2SO_4, and 0.2 g L^{-1} coumarin.

Table S2. Electrochemical performances of multilayered 2D Sn nanodendrites and previously-reported Sn-based nanomaterials.

Sample	**Current density ($mA\ g^{-1}$)**	**Capacity after cycles ($mAh\ g^{-1}$)**	**Cycle no. (capacity retention (%))**
Ultrasmall Sn in carbon[1]	1000	415	500 (96)
Porous carbon/tin composite[2]	20	200	15 (67)
Sn-coated viral nanoforests[3]	50	405	150 (55)
Sn@wood fiber[4]	84	145	400 (63)
Yolk-shell Sn@C Eggette-like nanostructure[5]	100	400	50 (73)
Sn nanoparticles@porous carbon nanocages[6]	40	583	200 (70)
Hollow Sn[7]	20	220	50 (34)
Porous Sn[8]	424	519	500 (77)
Sn nanoparticles@ordered mesoporous carbon[9]	100	337	200 (82)
Ultrasmall Sn@N-doped carbon microcages[10]	50	332	300 (76)
This work	100	757	300 (97)

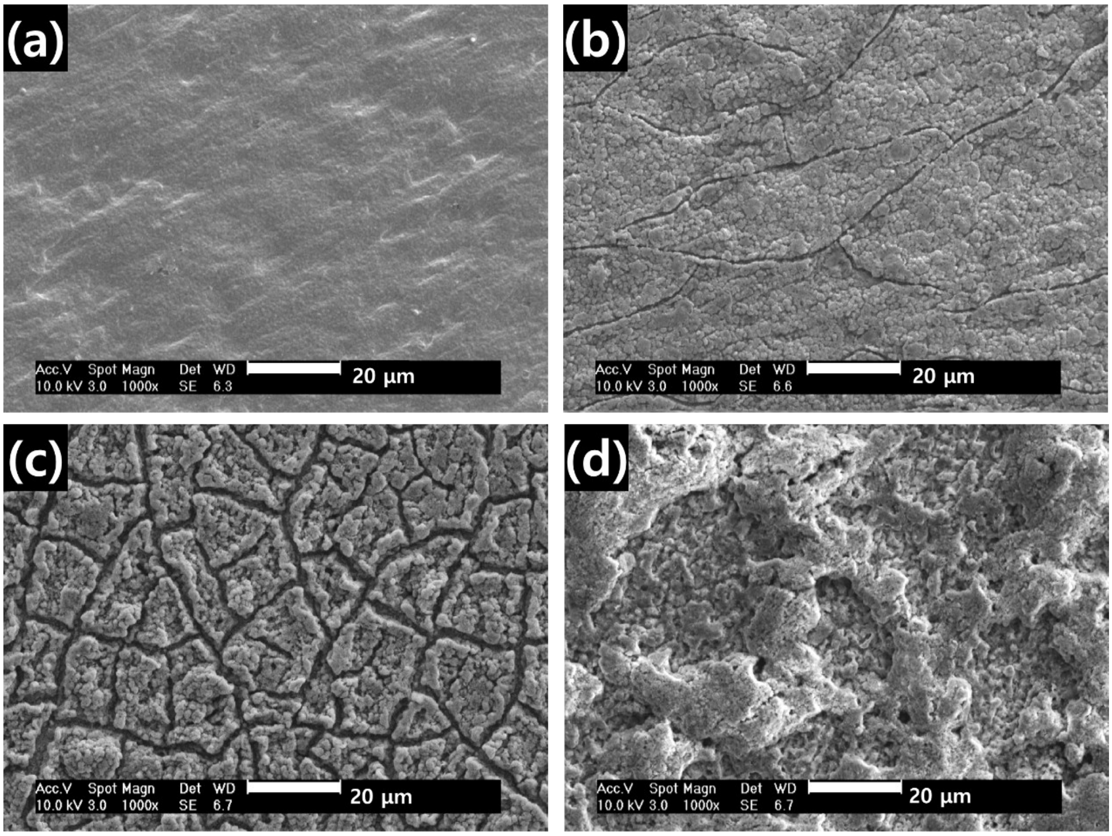

Figure S8. (a) SEM images of the dense Sn layer (a) as deposited, after(b) after 1 cycle, (c) after 10 cycles, and (d) after 30 cycles.

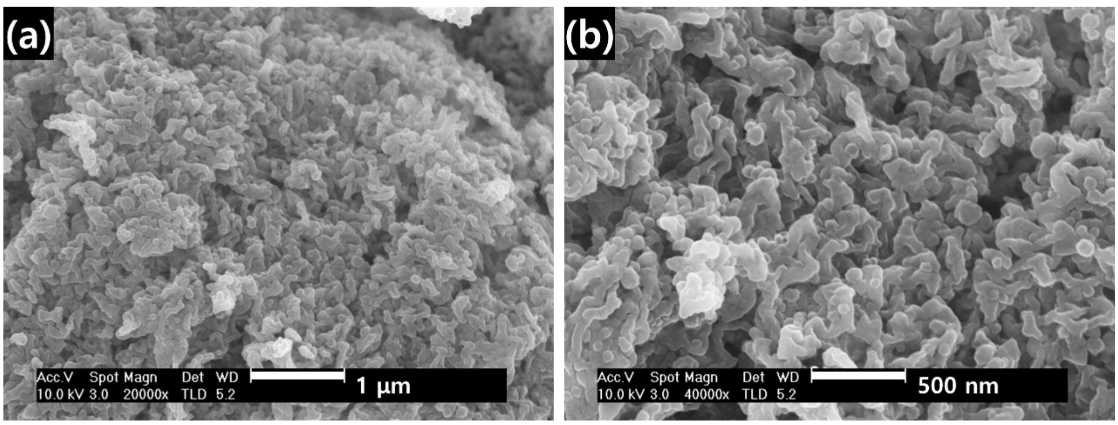

Figure S9. Morphology change of the multilayered 2D Sn nanodendrites after performing rate-capability test varying from 0.1 to 5 C and back to 0.1 C in a voltage range from 0.001 and 0.65 V at different magnifications.

References

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