

Nano Hard Carbon Anodes for Sodium-Ion Batteries

Dae-Yeong Kim ¹, Dong-Hyun Kim ², Soo-Hyun Kim ², Eun-Kyung Lee ³, Sang-Kyun Park ⁴,
Ji-Woong Lee ⁴, Yong-Sup Yun ⁵, Si-Young Choi ^{6,*} and Jun Kang ^{1,*}

¹ Division of Marine Engineering, Korea Maritime and Ocean University, 727 Taejong-ro, Yeongdo-gu, Busan 49112, Korea; smap1211@kmou.ac.kr

² Korea Maritime Equipment Research Institute/ICT Convergence Team, 435 Haeyang-ro, Yeongdo-gu, Busan 49111, Korea; kdh9942@komeri.re.kr (D.-H.K.); shkim@komeri.re.kr (S.-H.K.)

³ Department of Ocean Advanced Materials Convergence Engineering, Korea Maritime and Ocean University, 727 Taejong-ro, Yeongdo-gu, Busan 49112, Korea; elee@kmou.ac.kr

⁴ Division of Marine Information Technology, Korea Maritime and Ocean University, 727 Taejong-ro, Yeongdo-gu, Busan 49112, Korea; skpark@kmou.ac.kr (S.-K.P.); woongsengine@kmou.ac.kr (J.-W.L.)

⁵ Division of Marine System Engineering, Korea Maritime and Ocean University, 727 Taejong-ro, Yeongdo-gu, Busan 49112, Korea; ysyun@kmou.ac.kr

⁶ Department of Materials Science and Engineering, POSTECH, 77 Cheongam-ro, Pohang 37673, Korea

* Correspondence: junkang@kmou.ac.kr (J.K.); youngchoi@postech.ac.kr (S.-Y.C.);
Tel.: +82-51-410-4281 (J.K.); +82-54-279-2161 (S.-Y.C.)

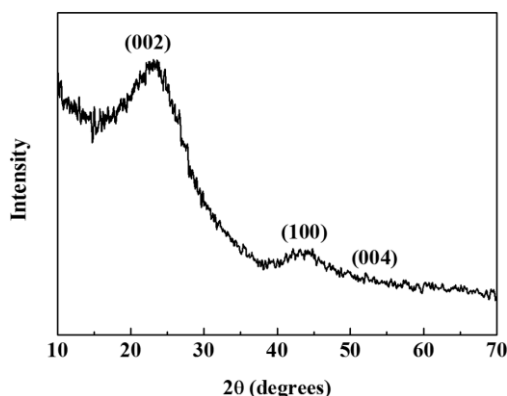


Figure S1. X-ray diffraction patterns of SCB.

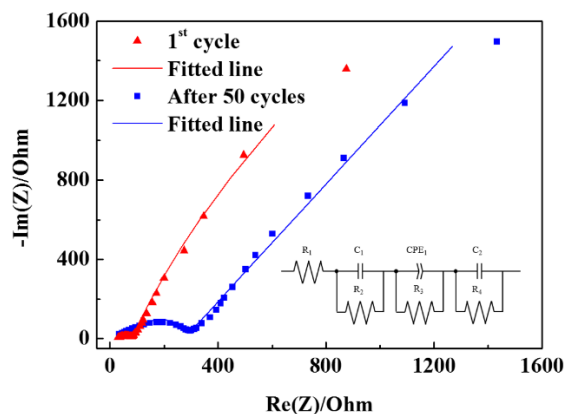


Figure S2. Nyquist plots of SCB (in a 1:1 (v/v) mixture of ethylene carbonate and dimethyl carbonate) after 1st and 50th cycles.

Table S1. The fitting values for the elements of 1st cycle and after 50 cycles.

	R_1 ($\Omega \text{ cm}^{-2}$)	C_1 (F cm^{-2})	R_2 ($\Omega \text{ cm}^{-2}$)	CPE_1 ($\text{S s}^{1/2} \text{ cm}^{-2}$)	R_3 ($\Omega \text{ cm}^{-2}$)	C_2 (F cm^{-2})	R_4 ($\Omega \text{ cm}^{-2}$)
1st cycle	24.7	1.193×10^{-1}	55.45	3.804×10^{-4}	66.45	1.109×10^{-2}	2,672
After 50 cycles	16.05	5.161×10^{-3}	241	7.593×10^{-7}	332.7	8.012×10^{-3}	3,285

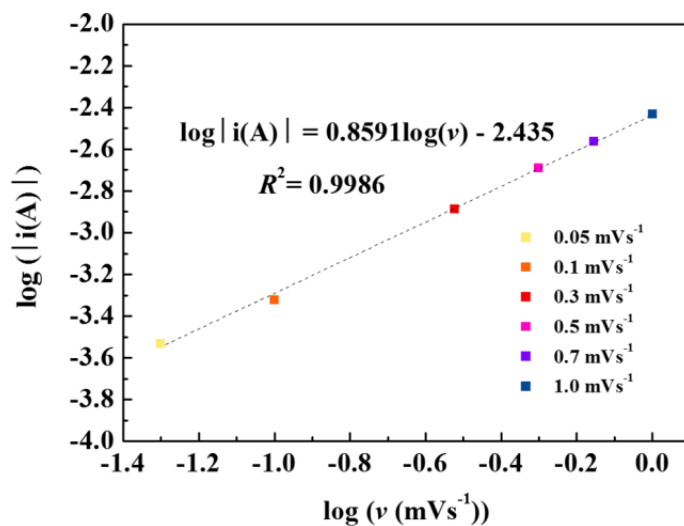


Figure S3. Determination of cathodic peak current values.

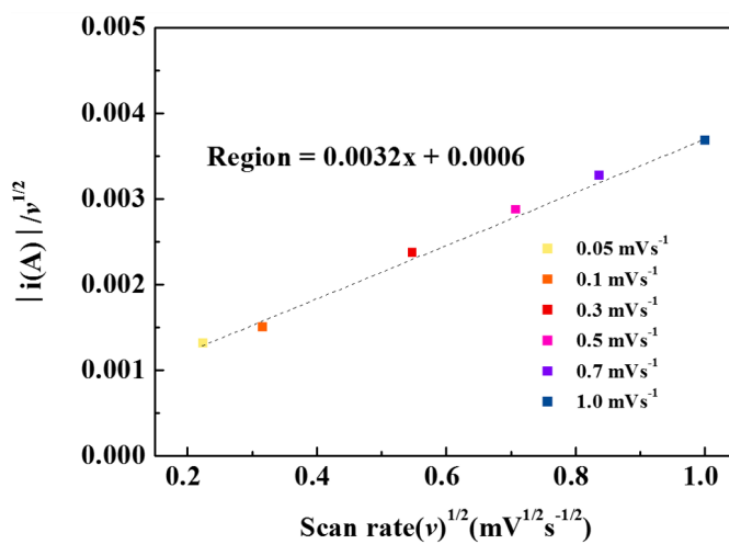


Figure S4. Cathodic peak current dependence on scanning rate, which is used to determine capacitive and intercalation contributions to energy storage.