

Supporting information

Single-Crystalline Ni(OH)₂ and NiO Nanoplatelet Arrays as Supercapacitor Electrodes

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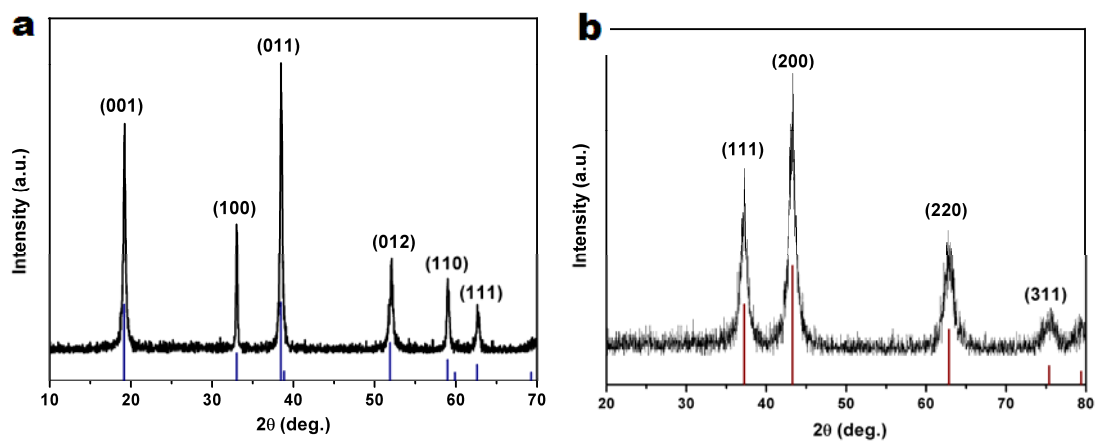


Figure S1. Typical XRD patterns of (a) Ni(OH)₂ powders collected from the same reaction container as that for Ni(OH)₂ arrays growth, and (b) NiO powders annealed at 400 °C for 2 h. The diffraction patterns are consistent the standard JCPDS cards No. 14-0117 (β -Ni(OH)₂) and 04-0835 (NiO), respectively.

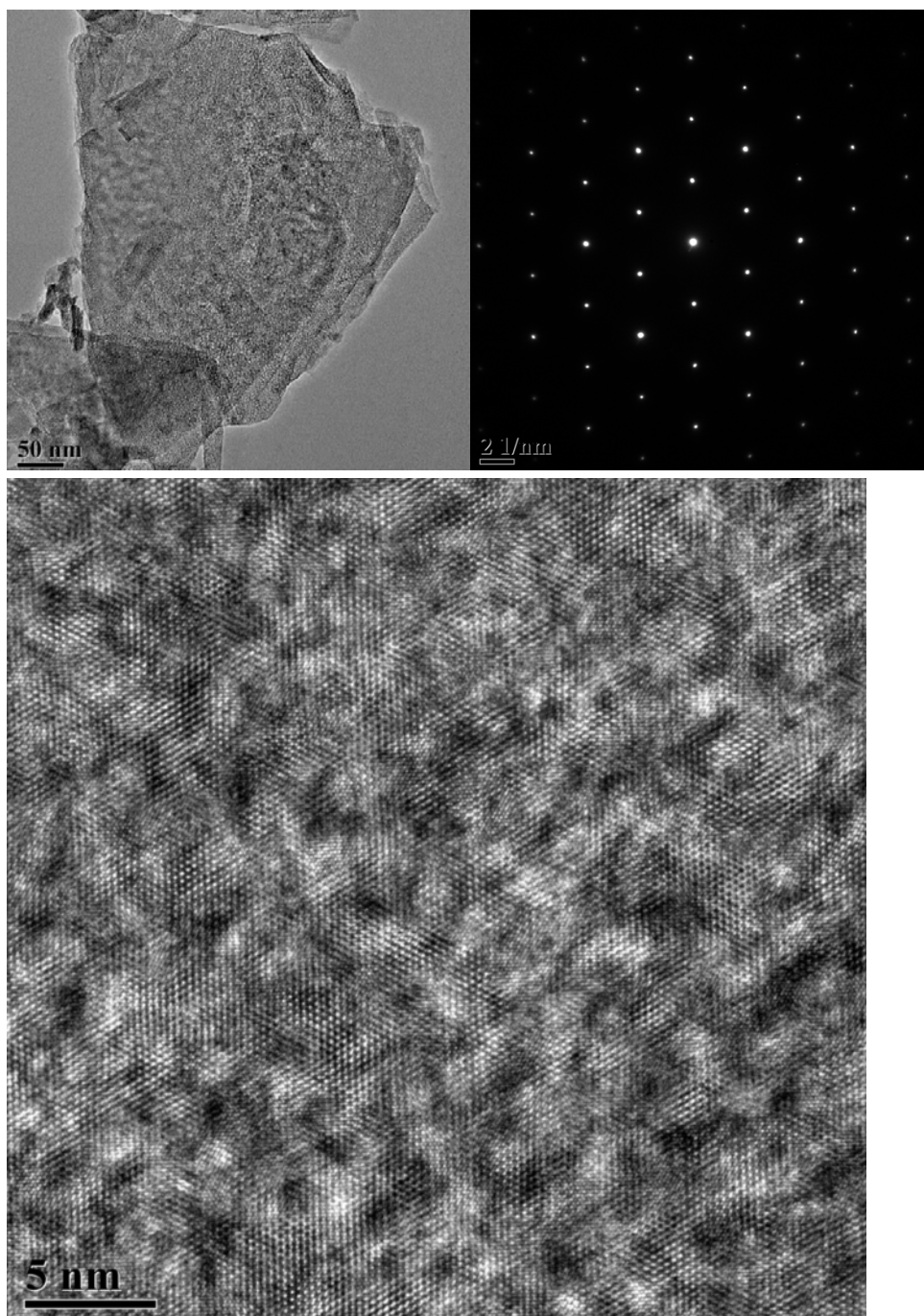


Figure S2a. Typical TEM, SAED, and HRTEM images of the as-deposited Ni(OH)₂ nanoplatelets.

The upper left image shows the nanopores in the nanosheets due to dehydration of Ni(OH)₂ to NiO under the irradiation of electron beam.

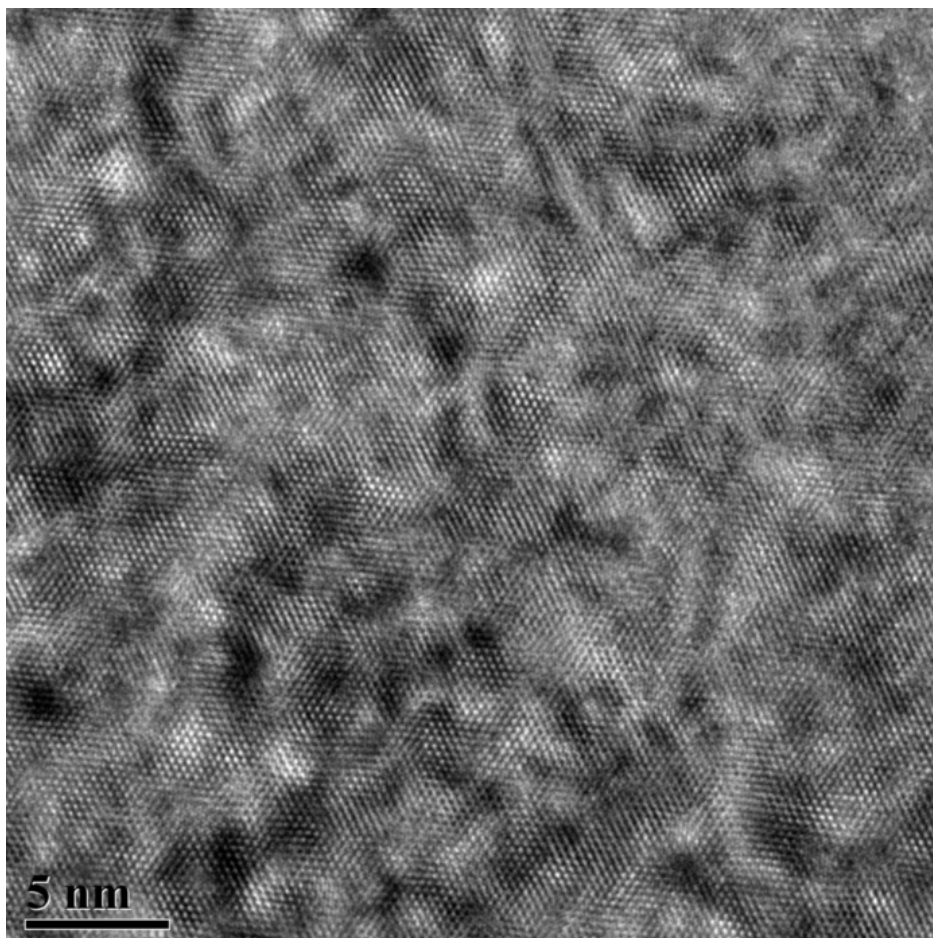


Figure S2b. Typical TEM, SAED, and HRTEM images of the as-deposited Ni(OH)₂ nanoplatelets. This figure also shows the TEM images of an additional Ni(OH)₂ nanoplatelets. All the TEM, SAED, and HRTEM images demonstrate that the Ni(OH)₂ nanoplatelets are single-crystalline and are stacked multilayer (001) planes along the [0001] direction.

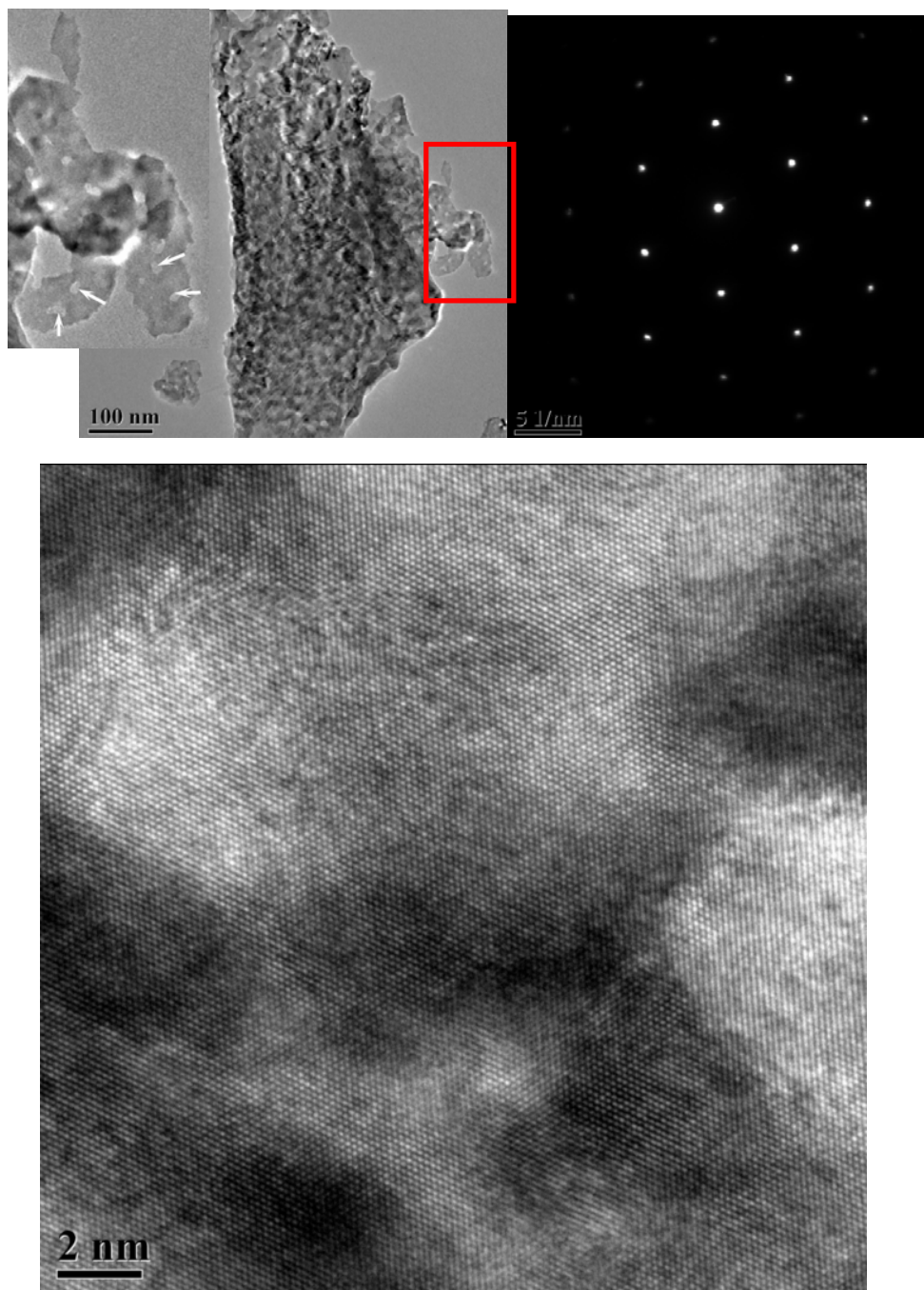


Figure S3. Typical TEM, SAED, and HRTEM images of the as-annealed NiO nanoplatelets. This figure shows the NiO (111) platelets. The insert in the upper left image shows that some holes are formed due to the release of small water molecules after annealing. But the hole does not damage to the alignment of the O and Ni atoms. A single-crystalline nanoplatelet is retained, and the exposed (111) plane can be indexed from the SAED and HRTEM images.

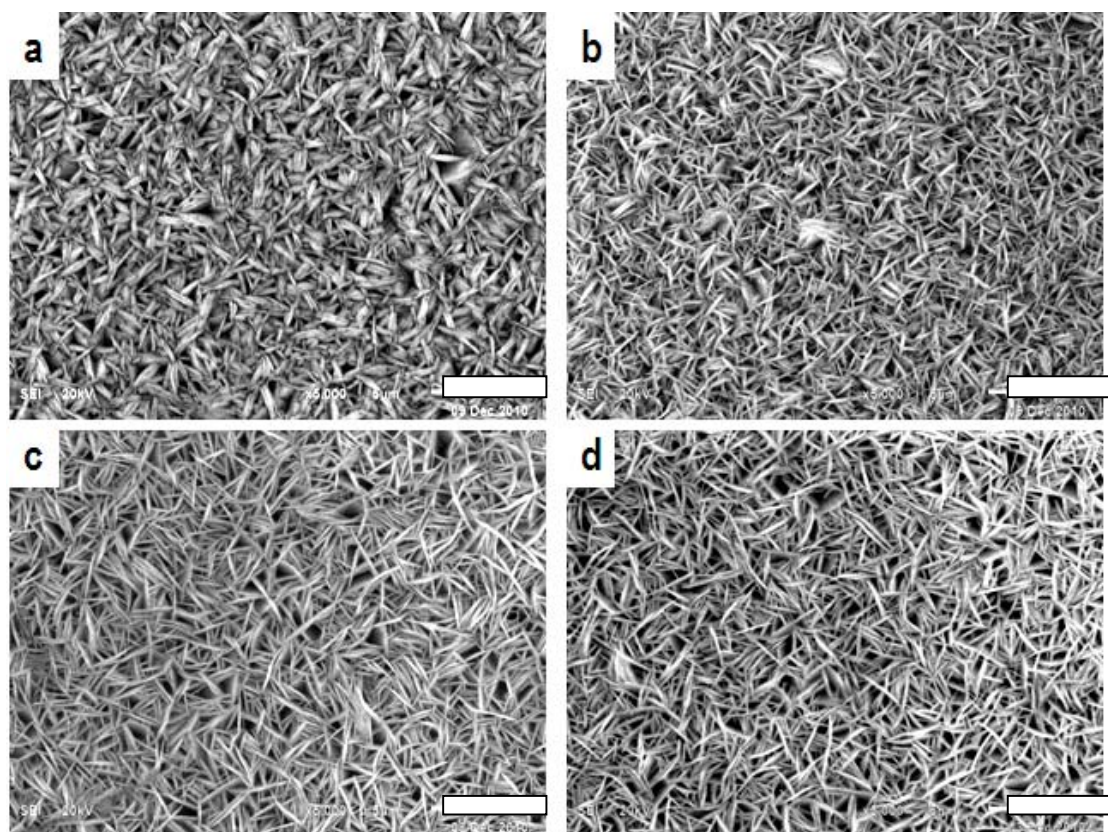


Figure S4. SEM images of the Ni(OH)₂ nanoarrays at 150 °C for different growth times (a) 2 h, (b) 5 h, (c) 10 h and (d) 24 h. All the scale bars correspond to 5 μm. Growth time does not play a key role in determining the final morphology of the nanoarrays. Increasing the growth time leads to the thicker array films. Similar morphology can also be obtained by varying the Ni²⁺ precursor and concentrations, the growth temperature in the range of 120 °C~180 °C.

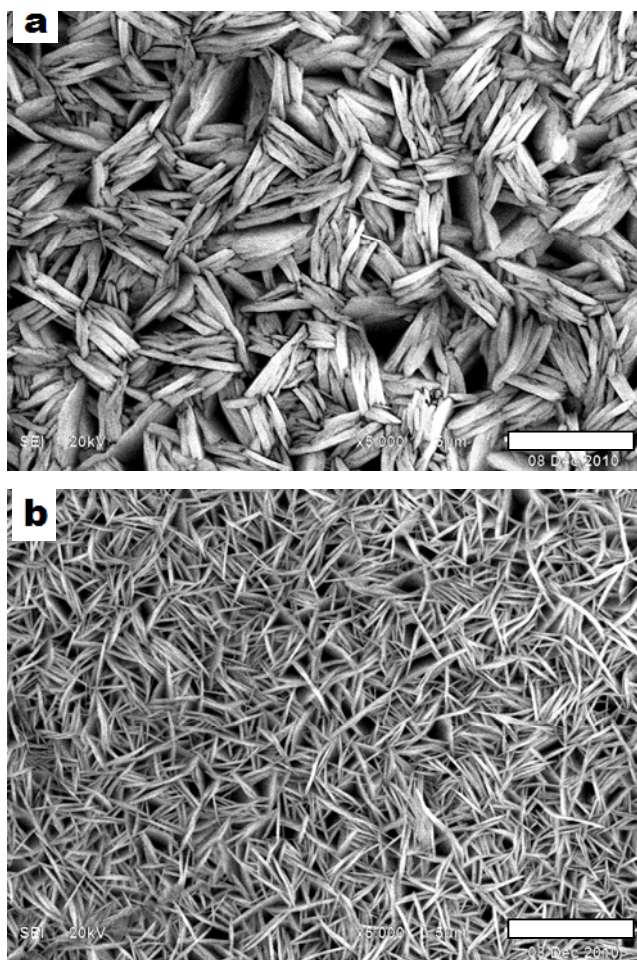


Figure S5. SEM images of the nanoarrays grown at 150 °C for 10 h with different NH₃ additions of, 10 mL (a) and 5 mL (b). All scale bars correspond to 5 μm. The concentration of NH₃ has a crucial effect on the morphology of array films. When small amount of ammonia aqueous solution (2.5 mL) is added, deposition occurs quickly at room temperature, but it is hard to control the morphological evolution of the film. When large amount of ammonia aqueous solution (10 mL) is introduced, poor adherence between film and the substrate always occurs, and the platelets become shorter and thicker, and compact construction is formed. When 15 mL of ammonia is added, no deposition occurs even at 180 °C for 20 h. 5 mL of ammonia is an optimized amount to get Ni(OH)₂ nanoarrays.

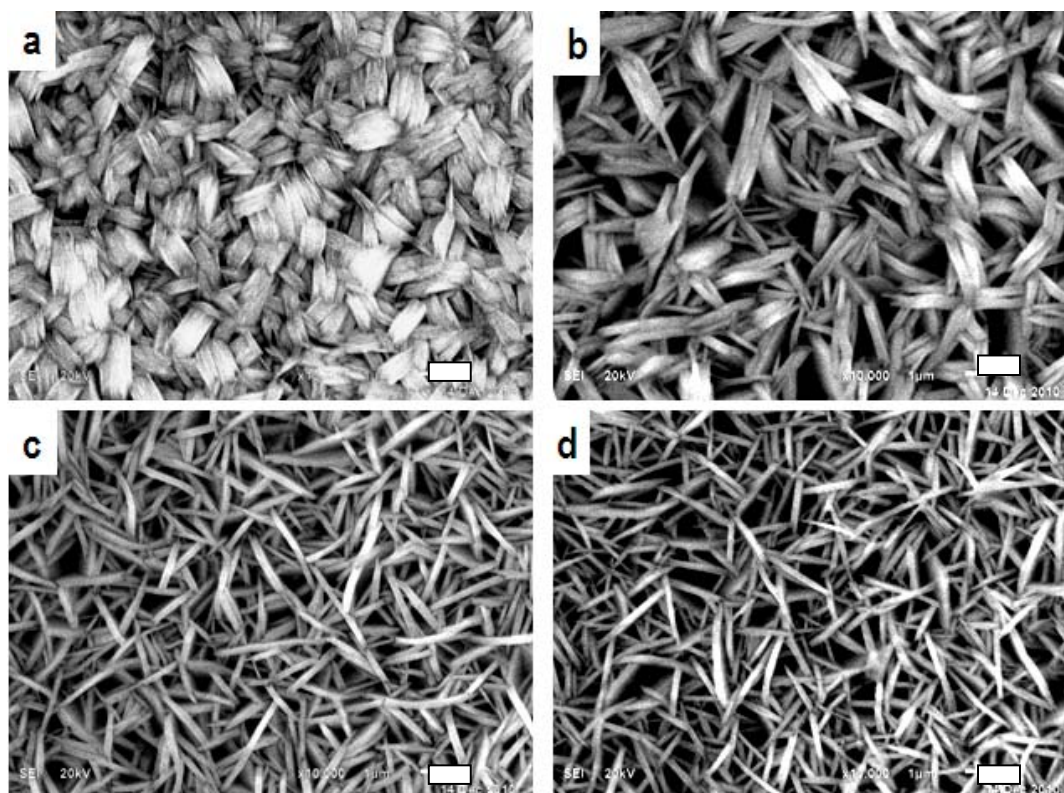


Figure S6. SEM images of the $\text{Ni}(\text{OH})_2$ nanoarrays grown at $150\text{ }^\circ\text{C}$ for 10 h with different persulfate concentrations of (a) 0 g, (b) 0.1 g, (c) 0.2 g and (d) 0.3g. All scale bars correspond to $1\text{ }\mu\text{m}$. The absence of persulfate leads to the formation of the compact structure with shorter and thicker nanoplatelets. Increasing the persulfate concentration, the nanoplatelets grow longer and form a porous architecture. It is well accepted that persulfate is selectively adsorbed on the (001) surface of $\text{Ni}(\text{OH})_2$ to suppress the growth along the [0001] direction, thus improves the longitude alignment vertical to the substrate.

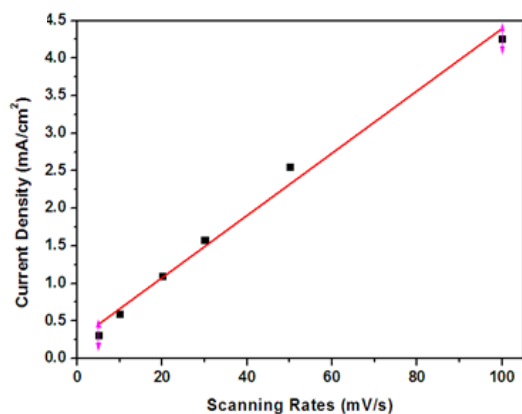


Figure S7. Peak current intensity as a function of scanning rate. The peak current intensity increases linearly with the scanning rate, confirming the pseudocapacitive behavior of NiO nanoarray film.

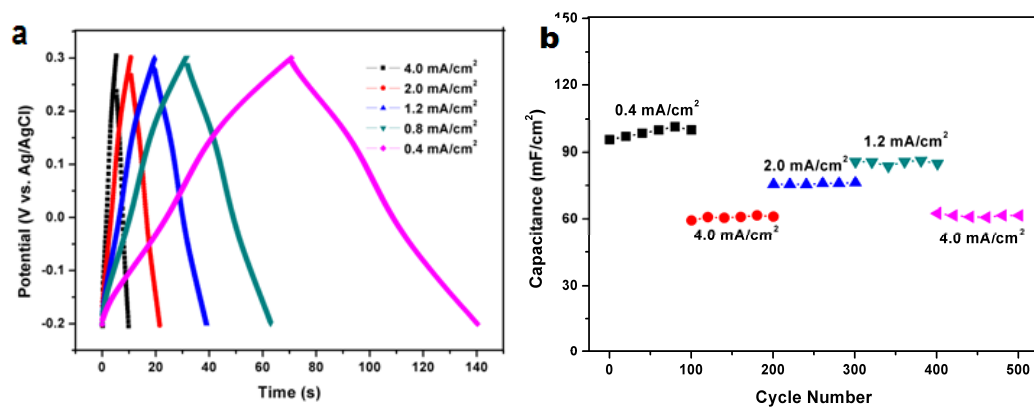


Figure S8. (a) Typical galvanostatic charge/discharge curve and cycling performance with different current densities for NiO arrays with 1 day growth time in 1M KOH aqueous solution. (b) Cycling performance with different current densities also confirm the high stability of such NiO nanoarrays constructed architecture.

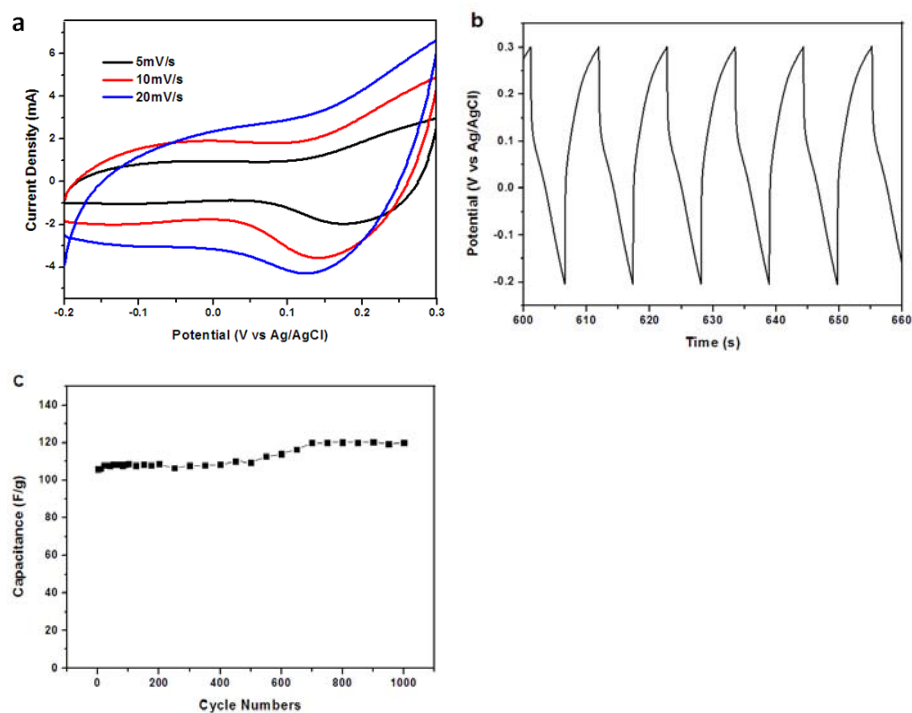


Figure S9. (a) Cyclic voltammograms at scan rates from 5 to 20 mV/s, (b) typical galvanostatic charge/discharge curve, and (c) Cycling performance of NiO powders (surface area 53 m²/g compared to 92 m²/g of NiO nanoplatelet array).