Electronic Supplementary Material (ESI) for Nanoscale.

Fabrication of Ternary $NiCoMoO_x$ with Yolk-Shell Hollow Structure as a Positive Electrode Material for High-Performance Electrochemical Capacitor Applications

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- Synthesis of Ni-Glycerate

As per the standard procedure, 0.25 mmol of Ni $(NO_3)_2 \cdot 6H_2O$ was introduced into a 25 mL mixture of glycerol and isopropanol in a 1:4 V/V ratio, all while under continuous stirring. Subsequent to dissolution, the resulting clear mixture was transferred into a Teflon-lined stainless-steel autoclave and maintained at a temperature of 200°C for a period of 24 hours. After cooling to room temperature, the precipitate thus formed was separated through centrifugation, underwent ethanol washing, and was then dried overnight at a temperature of 50°C.

- Synthsis of NiCo-Glycerate

Initially, 30 mg of Ni-Glycerate was dispersed within 20 mL of isopropanol for a duration of 10 minutes. Subsequently, the resultant solution was subjected to reflux and stirring at 90 ^{o}C. Following a period of 20 minutes, 5 mL of an aqueous solution containing 0.25 mmol of Co $(NO_3)_2 \cdot 6H_2O$ was introduced to the aforementioned solution. The resultant mixture was maintained under reflux at 90 °C for a duration exceeding 4 hours. Subsequent to these steps, the product underwent several rounds of ethanol washing and was subsequently dried at a temperature of 70 ^{o}C overnight.

- Synthesis of NiCoMo-Glycerate

To initiate, 30 mg of NiCo-Glycerate was dispersed in 10 mL of isopropanol. Subsequently, the solution was subjected to heating at 90 ^{o}C for a duration of 15 minutes, after which a combination of 5 mL of an aqueous solution containing 0.25 mmol of $Na_2MoO_4.2H_2O$ was introduced. The ensuing reaction was allowed to proceed for an additional 4 hours. Following these steps, the resultant product underwent multiple rounds of ethanol washing before being dried overnight at a temperature of 70 ^{o}C.

- Synthesis of NiCoMoOx YSHSs

For the subsequent heat treatment steps aimed at obtaining NiCoMo-oxide, the dried precursors underwent annealing at 400 °C under ambient air conditions for a duration of 2 hours, employing a heating rate of 2 °C min^{-1}.

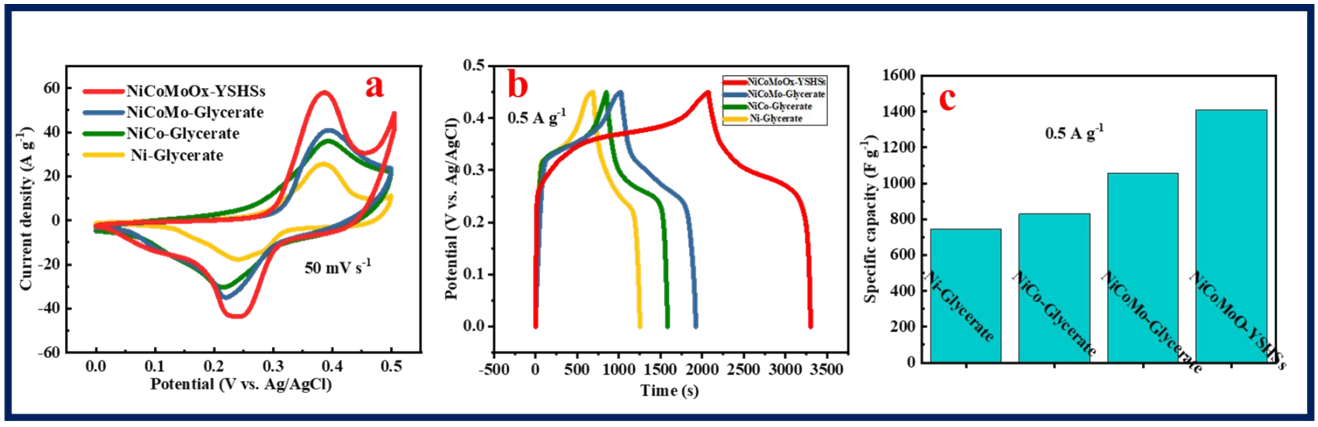

Figure 1. (a) CV curves of Ni-Glycerate, NiCo-Glycerate, NiCoMo-Glycerate and $NiCoMoO_x$ YSHSs at scan rate of 50 mV s^{-1} **(b)** GCD curves of Ni-Glycerate, NiCo-Glycerate, NiCoMo-Glycerate and $NiCoMoO_x$ YSHSs at current density of 0.5 A g^{-1} **(c)** comparison between specific capacity of the prepared electrode materials at current density of 0.5 A g^{-1}.

- Synthesis of NCMO-Spheres

The methodology employed for the creation of NCMO-Spheres involves a straightforward two-step process. Initially, a mixture comprising 1 mmol of Ni $(NO_3)_2 \cdot 6H_2O$, 1 mmol of Co $(NO_3)_2 \cdot 6H_2O$, and 1 mmol of $Na_2MoO_4 \cdot 2H_2O$ was dissolved in a 25 mL mixture of glycerol and isopropanol (1:4 V/V) under stirring conditions. Subsequently, the resulting clear mixture was transferred to a Teflon-lined stainless-steel autoclave and maintained at 200°C for a duration of 24 hours. Following cooling to room temperature, the resulting precipitate was separated via centrifugation, subjected to ethanol washing, and dried overnight at 50°C. For the subsequent heat treatment steps aimed at obtaining Ni-Co-Mo oxide, the dried precursors underwent annealing at 450°C under ambient air conditions for a duration of 2 hours, employing a heating rate of 20 °C min^{-1}.

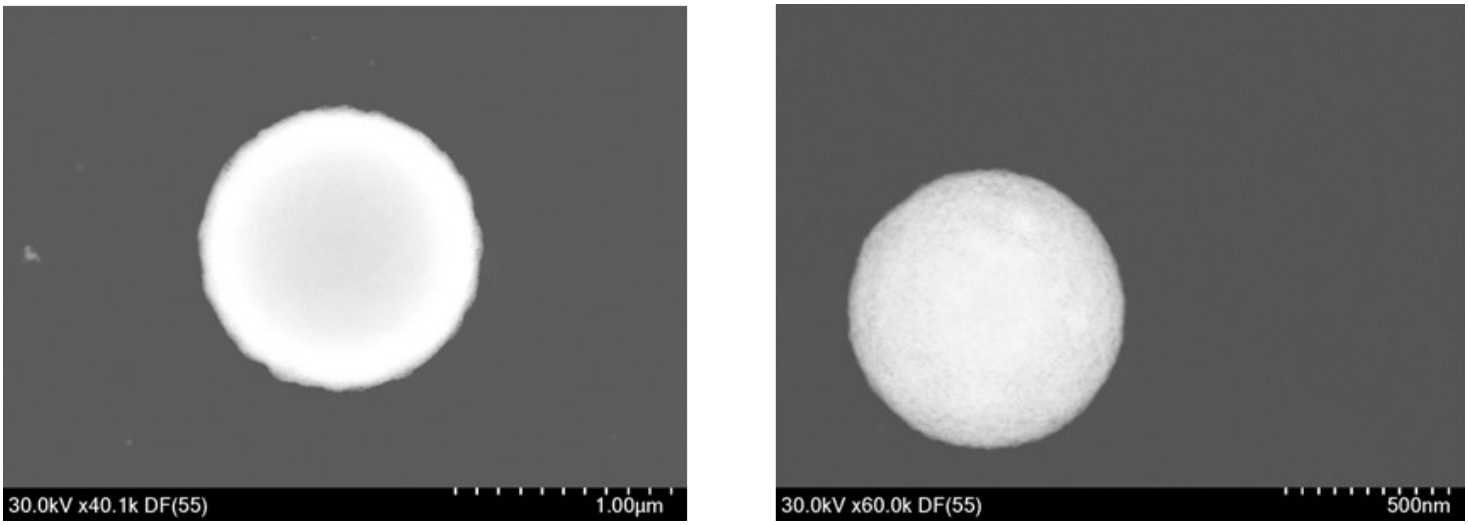

Figure 2. STEM images of $NiCoMoO_x$ spheres after thermal

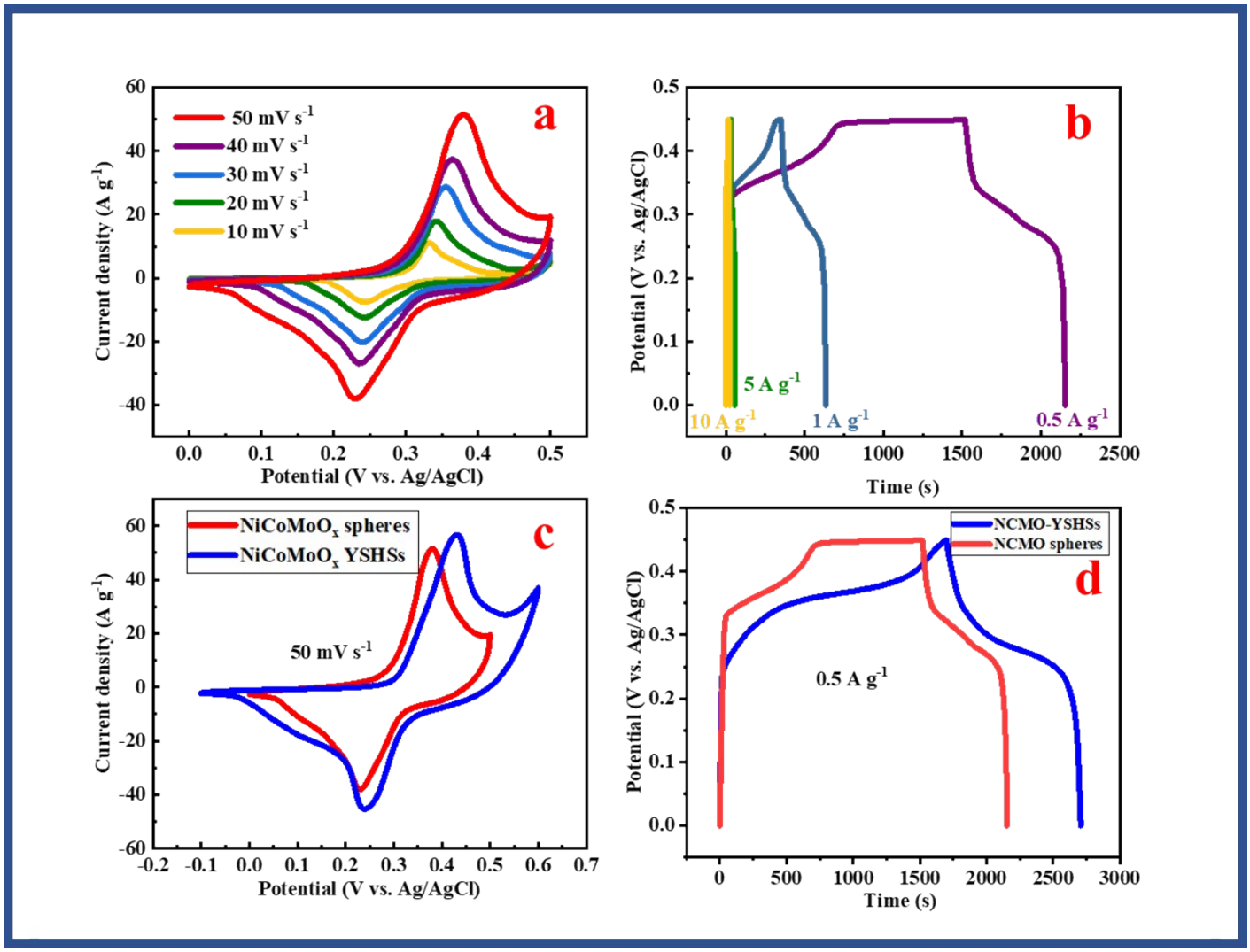

Figure 3. (a) CV curves of $NiCoMoO_x$ spheres at different scan rates, **(b)** GCD curves of $NiCoMoO_x$ spheres at different current densities, **(c)** comparison between CV curves of $NiCoMoO_x$ spheres and NiCoMO-YSHSs at scan rate of 50 mV s^{-1}, **(d)** comparison between GCD curves of $NiCoMoO_x$ spheres and NiCoMO-YSHSs at current density of O.5 A g^{-1}.

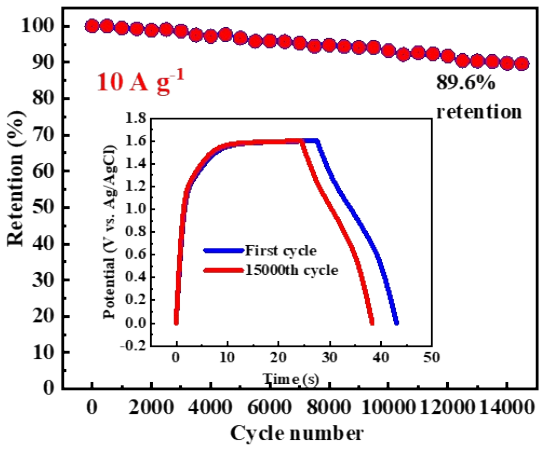

Figure 4. Stability test of NCMO-YSHSss (+) // AC (-) asymmetric device at higher current density of 10 A g^{-1}.

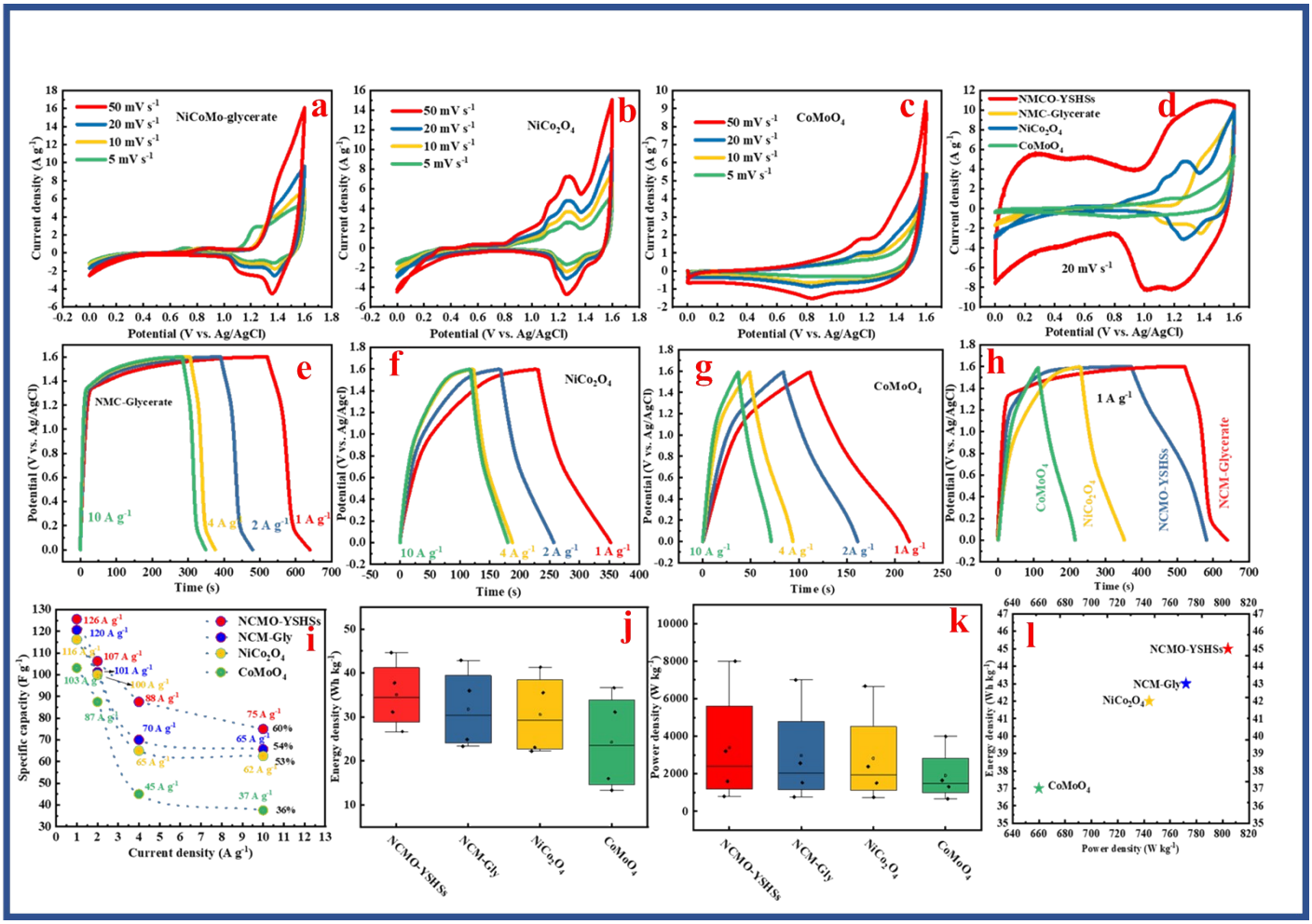

Figure 5. (a, b and c) CV curves of NCM-glycerate (+) // AC (-), $NiCo_2O_4$ (+) // AC (-) and $CoMoO_4$ (+) // AC (-) asymmetric devices at different scan rates, **(d)** CV curves of NCMO- YSHSs (+)// AC (-), NCM-glycerate (+) // AC (-), $NiCo_2O_4$ (+) // AC (-) and $CoMoO_4$ (+) // AC (-) asymmetric devices at scan rate of 20 mV s^{-1}, **(e, f and g)** GCD curves of NCM-glycerate (+) // AC (-), $NiCo_2O_4$ (+) // AC (-) and $CoMoO_4$ (+) // AC (-) asymmetric devices at different current densities, **(h)** GCD curves of NCMO- YSHSs (+)// AC (-), NCM-glycerate (+) // AC (-), $NiCo_2O_4$ (+) // AC (-) and $CoMoO_4$ (+) // AC (-) asymmetric devices at current density of 1 A g^{-1}, **(i)** Rate capability of NCMO-YSHSs (+)// AC (-), NCM-glycerate (+) // AC (-), $NiCo_2O_4$ (+) // AC (-) and $CoMoO_4$ (+) // AC (-) asymmetric devices, **(j)** Comparison between energy densities of NCMO- YSHSs (+)// AC (-), NCM-glycerate (+) // AC (-), $NiCo_2O_4$ (+) // AC (-) and $CoMoO_4$ (+) // AC (-) asymmetric devices, **(k)** Comparison between power densities of NCMO- YSHSs (+)// AC (-), NCM-glycerate (+) // AC (-), $NiCo_2O_4$ (+) // AC (-) and $CoMoO_4$ (+) // AC (-) asymmetric devices, **(l)** Simultaneous comparison of highest energy density alongside its associated power density across asymmetric devices of NCMO- YSHSs (+)// AC (-), NCM-glycerate (+) // AC (-), $NiCo_2O_4$ (+) // AC (-) and $CoMoO_4$ (+) // AC (-).