Supplementary Information

Coupling Ag-doping and rich oxygen vacancies in mesoporous NiCoO nanorods supported on nickel foam for highly efficient oxygen evolution

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Detailed calculation process of crystalline size:

Scherrer Equation:

\[ D = \frac{k\lambda}{\beta \cos \theta} \]

where:

- \( k \) is a dimensionless shape factor; \( k = 0.89 \) in our article.
- \( \lambda \) is the X-ray wavelength; \( \lambda = 0.15 \) in our article.
- \( \beta \) is the line broadening at half the maximum intensity (FWHM), after subtracting the instrumental line broadening, in radians.
- \( \theta \) is the Bragg angle (in degrees).
Fig. S1 TEM mappings of Ni-Co@Ag40/NF
Fig. S2 XPS spectra of Ni-Co@Ag40/NF: (a) survey; (b) Ni 2p; (c) Co 2p; (d) Ag 3d; (e) O 1s.
Fig. S3 XRD patterns of Ag0/NF and Ag40/NF.
Fig. S4 XRD pattern of Ni-Co@Ag40/NF.
Fig. S6 SEM images of (a) Ag0/NF; (b) Ag40/NF.
Fig. S7 SEM images of NiCoO@Ag0/NF-Ar
Fig. S8 SEM images of NiCoO@Ag40/NF-Air
Fig. S9 The corresponding SEM image for performing EDX profile
Fig. S10 CVs of the double-layer capacitance measurement for the six different samples in 1 M KOH in the non-Faradaic region of 0.15-0.25 V vs. SCE with different scan rates, varying from 40 mV s\(^{-1}\) to 120 mV s\(^{-1}\):
(a) NiCoO/NF; (b) Ni-Co@Ag0/NF; (c) Ni-Co@Ag40/NF; (d) NiCoO@Ag0/NF-Ar; (e) NiCoO@Ag40/NF-Air; (f) NiCoO@Ag40/NF-Ar.
**Table S1** Calculation results of crystalline size based on XRD patterns

<table>
<thead>
<tr>
<th>Crystalline phase</th>
<th>2-Theta</th>
<th>FWHM</th>
<th>Crystalline size/nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co based hydroxide hydrate</td>
<td>39.135</td>
<td>0.1224</td>
<td>71</td>
</tr>
<tr>
<td>CoO</td>
<td>42.423</td>
<td>0.204</td>
<td>39.8</td>
</tr>
<tr>
<td>Co$_3$O$_4$</td>
<td>36.963</td>
<td>0.2880</td>
<td>28.2</td>
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</table>
Table S2 Comparison of the OER activity for several recently reported highly active transition metal oxides electrocatalysts.

<table>
<thead>
<tr>
<th>Catalyst</th>
<th>$J$ (mA cm$^{-2}$)</th>
<th>Overpotential (mV)</th>
<th>Electrolyte</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NiCoO@Ag40/NF-Ar</td>
<td>100</td>
<td>350</td>
<td>1 M KOH</td>
<td>This work</td>
</tr>
<tr>
<td>Reduced Co$_3$O$_4$ NW</td>
<td>13.1</td>
<td>420</td>
<td>1 M KOH</td>
<td>S1</td>
</tr>
<tr>
<td>Co$_3$O$_4$ nanoparticles</td>
<td>10</td>
<td>420</td>
<td>1 M KOH</td>
<td>S2</td>
</tr>
<tr>
<td>NiCo layered double hydroxide</td>
<td>10</td>
<td>367</td>
<td>1 M KOH</td>
<td>S3</td>
</tr>
<tr>
<td>Ni$<em>x$Co$</em>{3-x}$O$_4$ nanowire array</td>
<td>10</td>
<td>370</td>
<td>1 M KOH</td>
<td>S4</td>
</tr>
<tr>
<td>Ni substituted Co$_3$O$_4$ nanowire</td>
<td>10</td>
<td>370</td>
<td>1 M KOH</td>
<td>S5</td>
</tr>
<tr>
<td>Cu$_2$–Cu foams</td>
<td>10</td>
<td>350</td>
<td>1 M KOH</td>
<td>S6</td>
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</tbody>
</table>
**Table S3** Comparison of OER activity data for different electrocatalysts.

<table>
<thead>
<tr>
<th>Catalyst</th>
<th>$\eta$ at $J=100$ mA cm$^{-2}$ [mV]</th>
<th>Tafel slope (mV dec$^{-1}$)</th>
<th>Cdl (mF cm$^{-2}$)</th>
<th>Rct ($\Omega$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NiCoO@Ag40/NF-Ar</td>
<td>350</td>
<td>104</td>
<td>44</td>
<td>0.72</td>
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<tr>
<td>NiCoO@Ag40/NF-Air</td>
<td>370</td>
<td>147</td>
<td>32</td>
<td>1.28</td>
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<tr>
<td>NiCoO@Ag0/NF-Ar</td>
<td>370</td>
<td>128</td>
<td>25</td>
<td>0.89</td>
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<tr>
<td>Ni-Co@Ag40/NF</td>
<td>400</td>
<td>153</td>
<td>18</td>
<td>1.32</td>
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<tr>
<td>Ni-Co@Ag0/NF</td>
<td>400</td>
<td>148</td>
<td>13</td>
<td>1.49</td>
</tr>
<tr>
<td>NiCoO/NF-Ar</td>
<td>410</td>
<td>185</td>
<td>6</td>
<td>3.98</td>
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</tbody>
</table>
References


