# Supporting Information for:

## A silica co-electrodeposition route to highly active Ni-based film electrode

**Liankui Wu,[a] Jiming Hu,*[a] Jianqing Zhang,[a, b] and Chunan Cao[a]**

[a] *Department of Chemistry, Zhejiang University, Hangzhou 310027, China. Fax: +86-571-87951895; Tel: +86-571-87953297. E-mail: kejmhu@zju.edu.cn*

[b] *State Key Laboratory for Corrosion and Protection, Institute of Metal Research, The Chinese Academy of Sciences, Shenyang 110016, China*

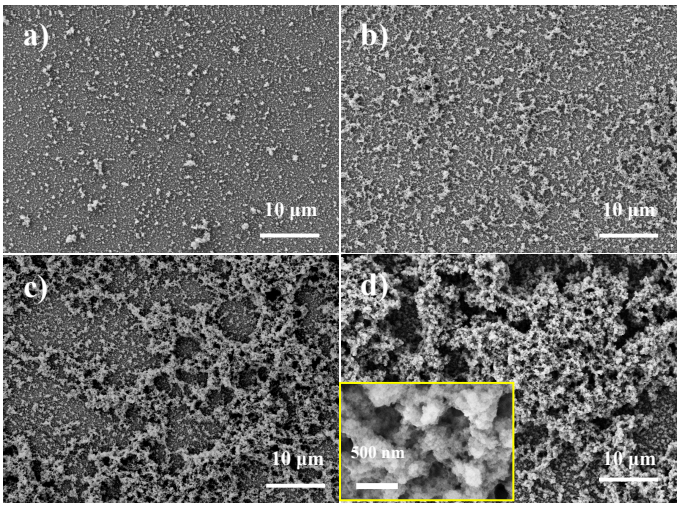



Fig. S1 Morphology of the $SiO_2$ films electrodeposited at -1.1 V vs. Ag/AgCl for 600 s (a), 1200 s (b), 1800 s (c) and 2400 s (d). The deposition precursor contains 45 mL of 0.2 M $Na_2SO_4$ / 0.2 M $H_3BO_3$, 5 mL ethanol and 0.25 mL TMOS. Inset shows the high magnification image.

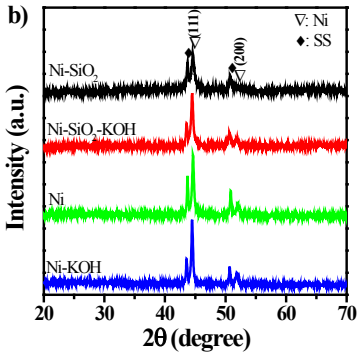



Fig. S2. XRD patterns of Ni and Ni-$SiO_2$ films before and after 50 repeated CV scans in 1.0 M KOH.

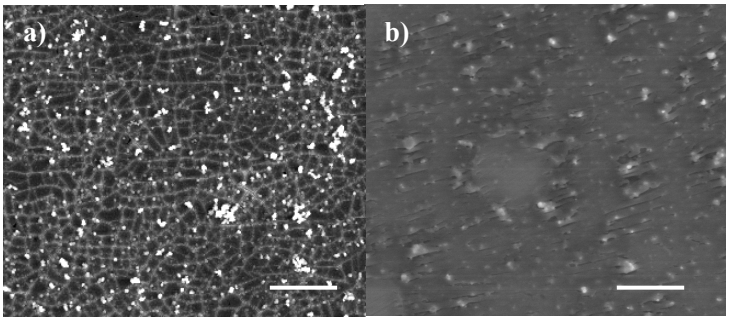
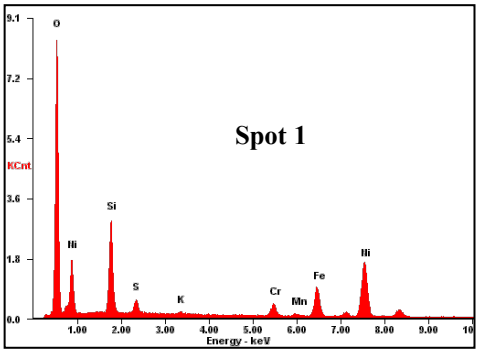
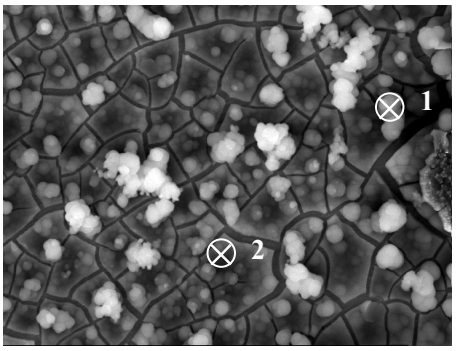
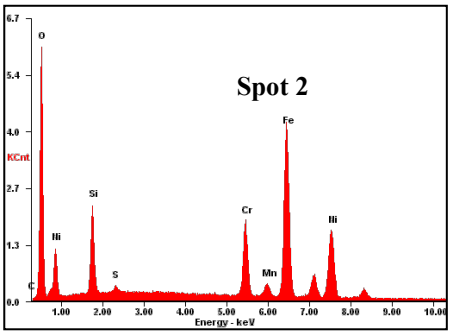



Fig. S3 SEM (a) and environment-SEM (b) images of the Ni-$SiO_2$ films. The scale bars correspond to 25 μm.



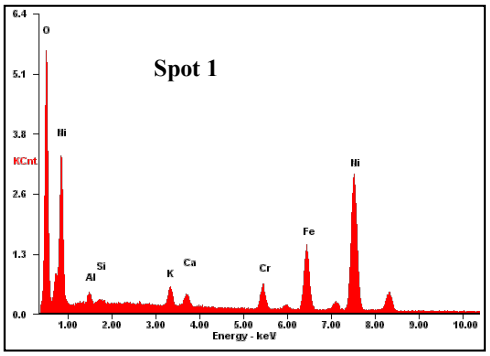

| Element | Wt % | At % |
|---|---|---|
| O K | 54.67 | 76.83 |
| SiK | 11.94 | 09.56 |
| S K | 01.62 | 01.13 |
| K K | 00.24 | 00.14 |
| CrK | 02.34 | 01.01 |
| MnK | 00.26 | 00.11 |
| FeK | 07.47 | 03.01 |
| NiK | 21.46 | 08.22 |



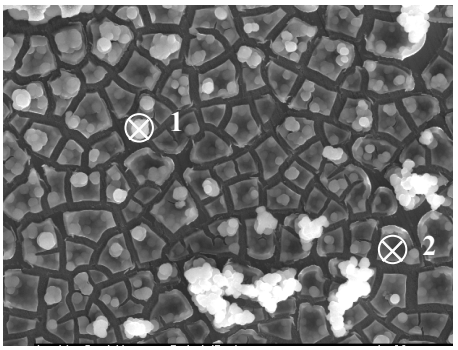



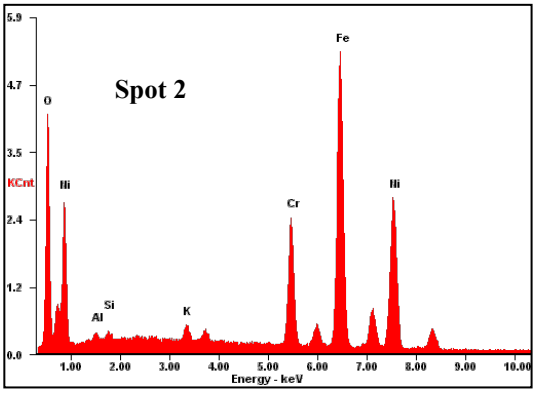

| Element | Wt % | At % |
|---|---|---|
| O K | 33.65 | 61.13 |
| SiK | 08.24 | 08.52 |
| S K | 00.56 | 00.51 |
| CrK | 08.77 | 04.91 |
| MnK | 00.61 | 00.33 |
| FeK | 29.81 | 15.52 |
| NiK | 18.35 | 09.08 |

Fig. S4 A scanning electron microscopy graph of a SS electrode coated with Ni-$SiO_2$ film, and the energy dispersive spectra taken from two typical positions of the film. The elements of Cr, Fe and Mn are from the SS substrate.




| Element | Wt % | At % |
|---|---|---|
| O K | 40.72 | 70.04 |
| AlK | 01.83 | 01.87 |
| SiK | 00.51 | 00.50 |
| K K | 01.75 | 01.23 |
| CrK | 03.53 | 01.87 |
| FeK | 11.78 | 05.80 |
| NiK | 39.88 | 18.69 |




| Element | Wt % | At % |
|---|---|---|
| O K | 23.10 | 50.73 |
| AlK | 00.95 | 01.24 |
| SiK | 00.67 | 00.84 |
| K K | 00.88 | 00.79 |
| CrK | 10.29 | 06.95 |
| FeK | 35.73 | 22.48 |
| NiK | 28.38 | 16.98 |

Fig. S5 A scanning electron microscopy graph of a SS electrode coated with Ni-$SiO_2$-KOH film, and the energy dispersive spectra taken from two typical positions of the film. The elements of Cr, Fe and Mn are from the SS substrate.

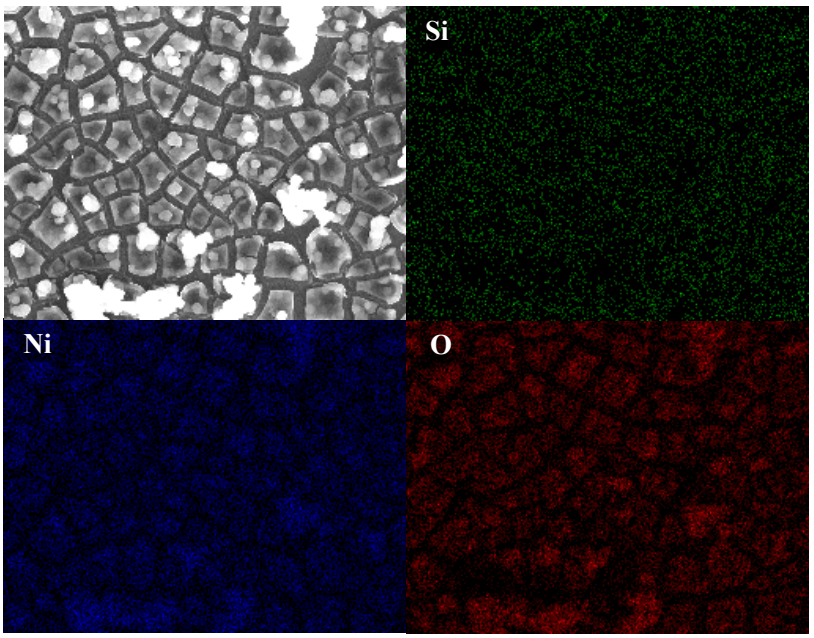



Fig. S6 A scanning electron micrograph of a SS electrode coated with Ni-$SiO_2$ film after underwent 50 repeated CV scan in 1.0 M KOH at scan rate of 20 mV $s^{-1}$ and the corresponding energy dispersive X-ray maps of the same sample showing the dispersion of Si, O, Ni on the SS surface.

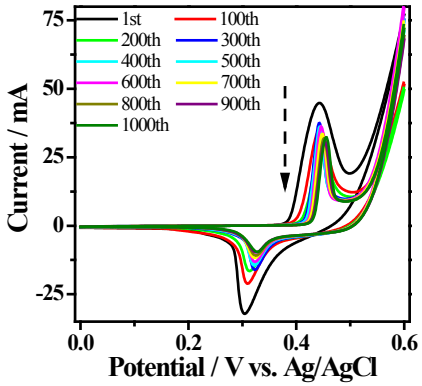



Fig. S7 Consecutive CV curves between 0 and 0.6 V for po-Ni film conducted in 1.0 M KOH at scan rate of 100 mV $s^{-1}$. The dotted arrow indicates the change direction of the anodic current density with the increasing scan number.

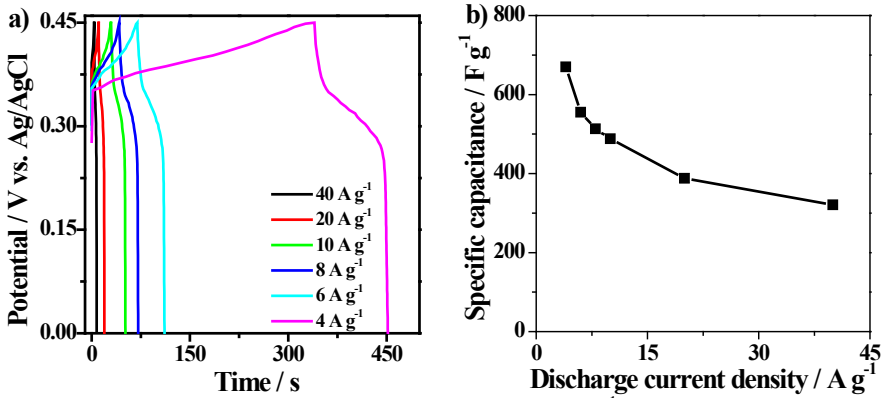



Fig. S8 (a) Galvanostatic charge-discharge curves at 4 - 40 A $g^{-1}$, (b) specific capacitance calculated from discharge curves of the po-Ni films in 1.0 M KOH.

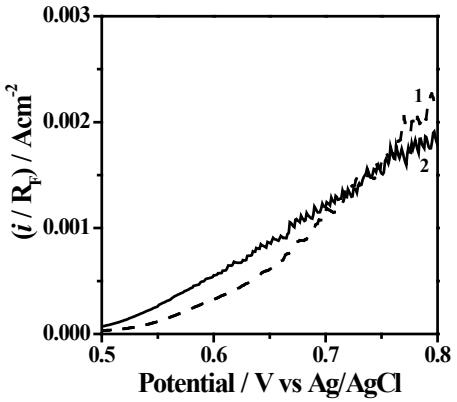



Fig. S9 The roughness factor-normalized current polarization curves toward OER for Ni (1) and po-Ni (2) film electrodes in 1.0 M KOH.

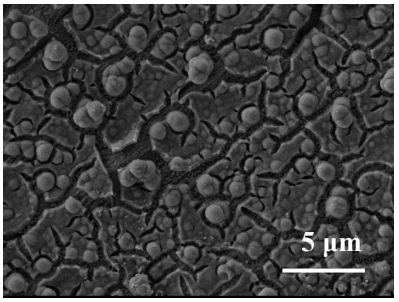



Fig. S10 SEM image of po-Ni film electrode after underwent 5 days electrolysis in 1.0 M KOH at 100 mA $cm^{-2}$.

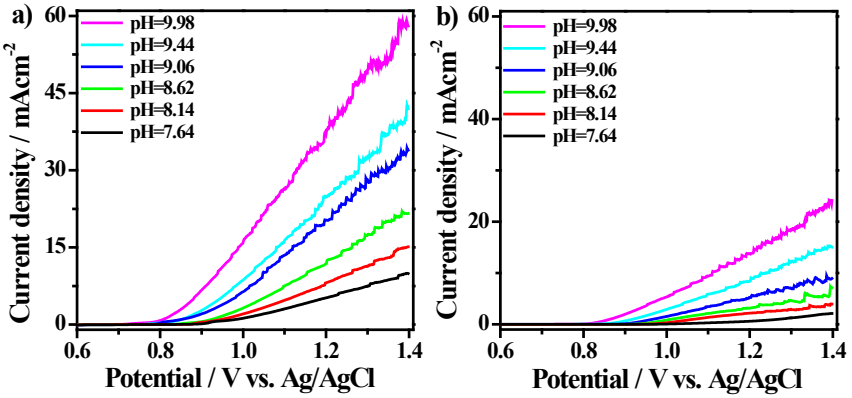



Fig. S11 Steady-state polarization curves of po-Ni (a) and Ni (b) films recorded in 1.0 M $H_3BO_3$ with a serials of pH from 7.64 to 9.98.