Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Supporting information

A facile strategy of "laser-direct-writing" to develop self-supported $Ni_{30}B_{70}$-Ti catalysts for boosted and durable alkaline oxygen evolution

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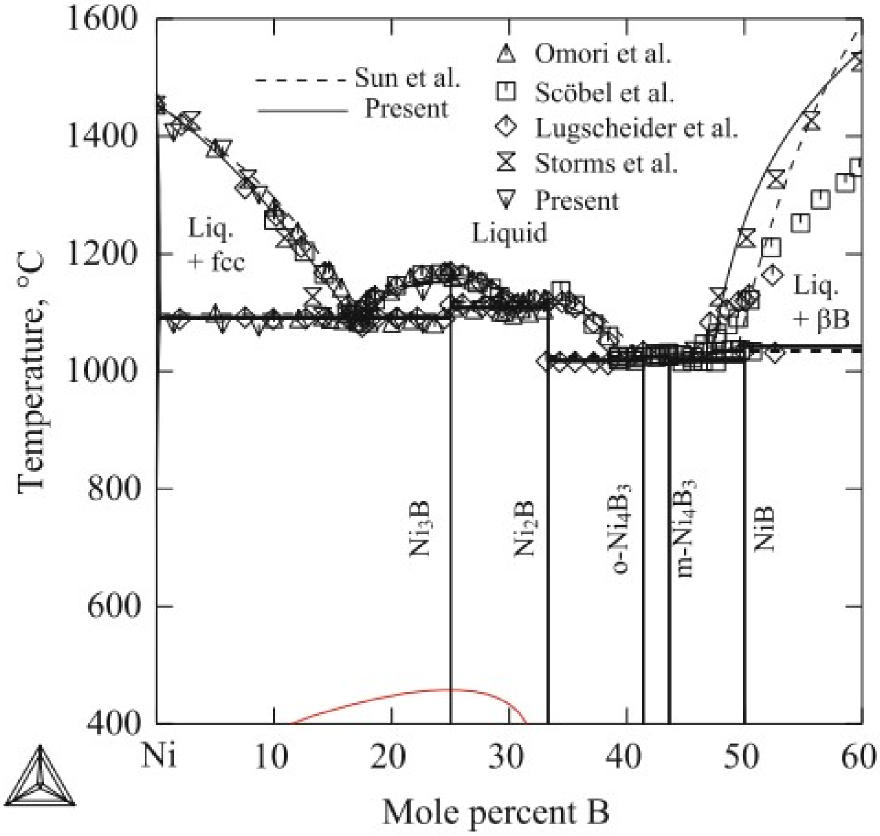

Fig. S1 Ni-B phase diagram.[1]

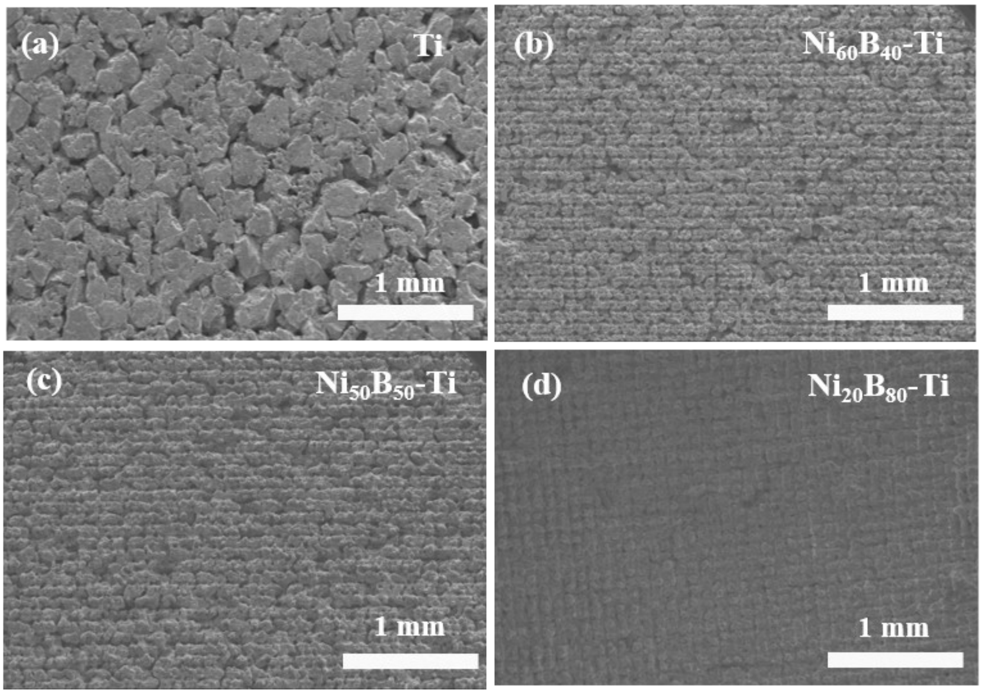

Fig. S2 SEM images of (a) Ti foam, (b) $Ni_{60}B_{40}$-Ti, (c) $Ni_{50}B_{50}$-Ti and (d) $Ni_{20}B_{80}$-Ti at a magnification of 35 times.

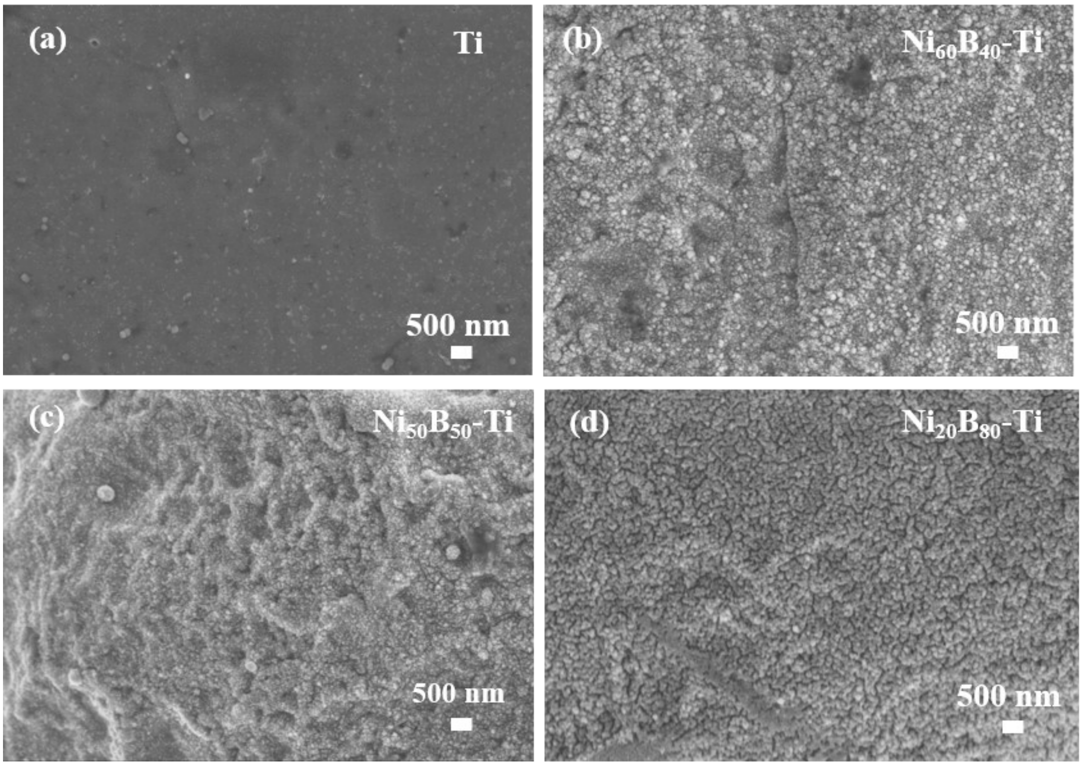

Fig. S3 SEM images of (a) Ti foam, (b) $Ni_{60}B_{40}$-Ti, (c) $Ni_{50}B_{50}$-Ti, and (d) $Ni_{20}B_{80}$-Ti at a magnification of 10 K times.

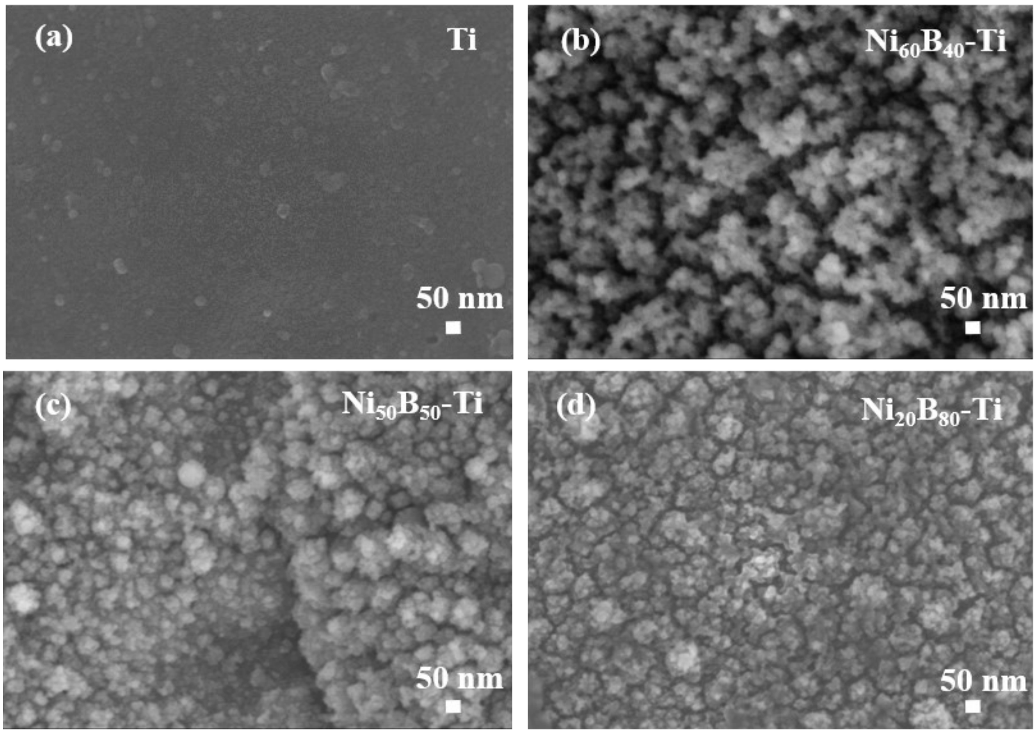

Fig. S4 SEM images of (a) Ti foam, (b) $Ni_{60}B_{40}$-Ti, (c) $Ni_{50}B_{50}$-Ti, and (d) $Ni_{20}B_{80}$-Ti at a magnification of 60 K times.

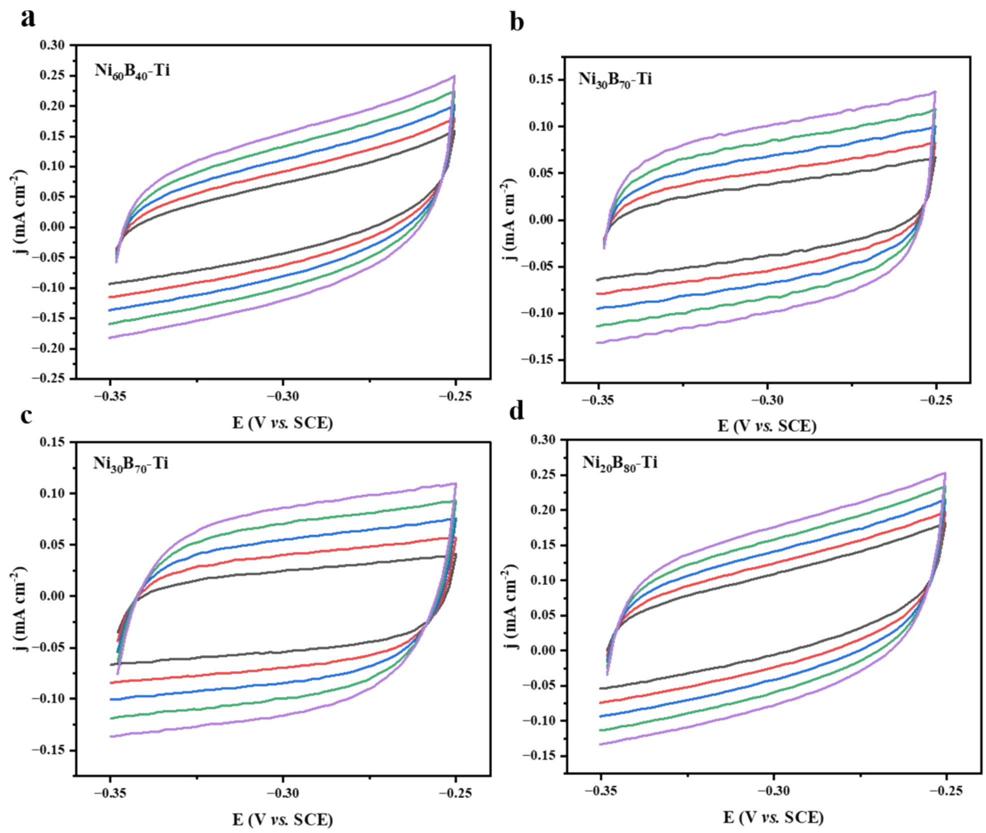

Fig. S5 ECSA of (a) $Ni_{60}B_{40}$-Ti, (b) $Ni_{50}B_{50}$-Ti, (c) $Ni_{30}B_{70}$-Ti, and (d) $Ni_{20}B_{80}$-Ti.

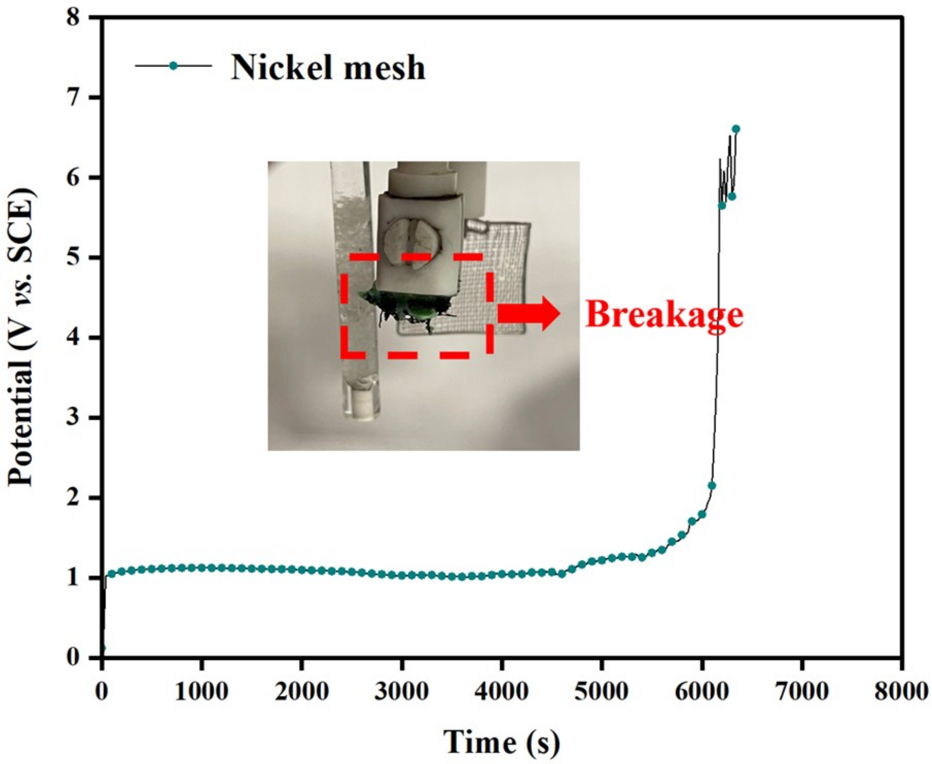

Fig. S6 The commercial nickel network stability test in simulated seawater with a current density of 100 mA cm^{-2}.

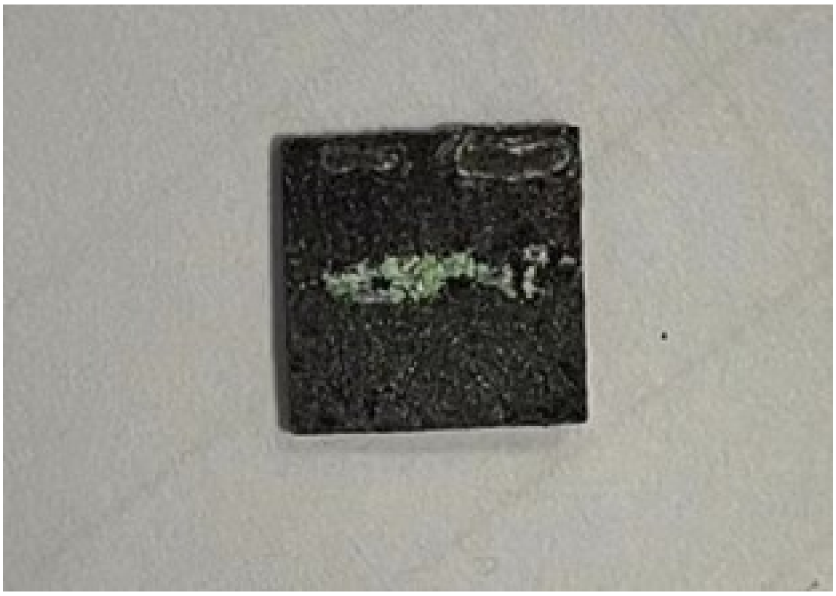

Fig. S7 Image of the $Ni_{30}B_{70}$-Ti sample after the stability test at a current density of 100 mA cm^{-2} in simulated seawater.

	CPE_1-T/ (F · cm^{-2})	**CPE_1-P/ (F · cm^{-2})**	**$R_2(R_{ct})$/ (Ω · cm^{-2})**	**CPE_2-T/ (F · cm^{-2})**	**CPE_2-P/ (F · cm^{-2})**	**R_3/ (Ω · cm^{-2})**
$Ni_{60}B_{40}$-Ti	1.14x10^{-3}	0.63	0.36	0.26	0.48	1.07
$Ni_{50}B_{50}$-Ti	1.38x10^{-3}	0.86	0.34	0.31	0.22	1.05
$Ni_{30}B_{70}$-Ti	5.12x10^{-4}	0.93	0.10	0.30	0.45	0.49
$Ni_{20}B_{80}$-Ti	7.12x10^{-4}	0.82	0.19	0.32	0.39	0.66

Table S1. The value of the fitted components in the equivalent circuit for $Ni_{60}B_{40}$-Ti, $Ni_{50}B_{50}$-Ti, $Ni_{30}B_{70}$-Ti, and $Ni_{20}B_{80}$-Ti.

Some calculation formulas involved in the article:

The overpotential is calculated by the following equation:

$E\ (vs.\ RHE) = E\ (vs.\ SCE) + 1.0672\ V$

$\eta_{OER} = \mathrm{E\ (vs.\ RHE)} - 1.23\ \mathrm{V}$

The ECSA is calculated by the following equation:

ECSA = Cdl/Cs(40 μF cm^{-2})

Cdl can be obtained by testing CV curves at different sweep speeds in non-Faraday intervals, and thus ECSA value can be obtained.

The electric quantity of Ni reduction is calculated by the following equation:

$$Q = \frac{\int j \cdot t dt}{m(Ni)}$$

$\int j \cdot t dt$ is obtained by the integration of the j-t curve. m (Ni) is obtained by multiplying the catalyst net mass by the mass percentage of the Ni element in EDS.

The Tafel is calculated by the following equation:

$$\eta = a + b \lg j$$

The Tafel curve can be obtained by plotting the logarithm of the current density against the electrode potential. The linear part of the curve is selected, and the Tafel slope is obtained by fitting its slope.

References

1. K. Oikawa and N. Ueshima, *J. Phase Equilib. Diff.*, 2022, **43**, 814-826.