A nitridation route to construct high-activity interfaces toward alkaline hydrogen evolution

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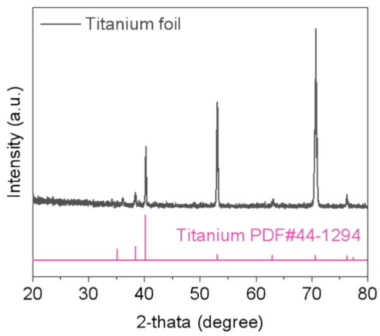

Fig. S1 XRD pattern of Ti foil.

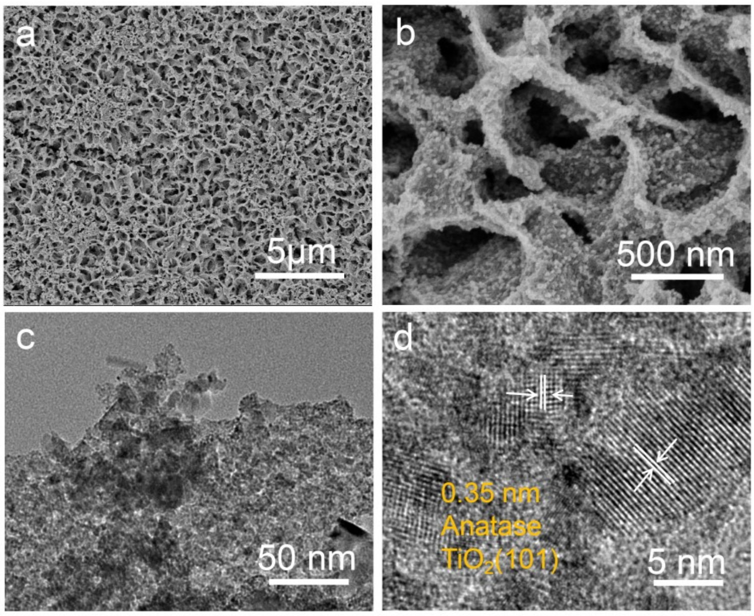

Fig. S2 SEM images of $Ru/H_2Ti_2O_5$ NBs.

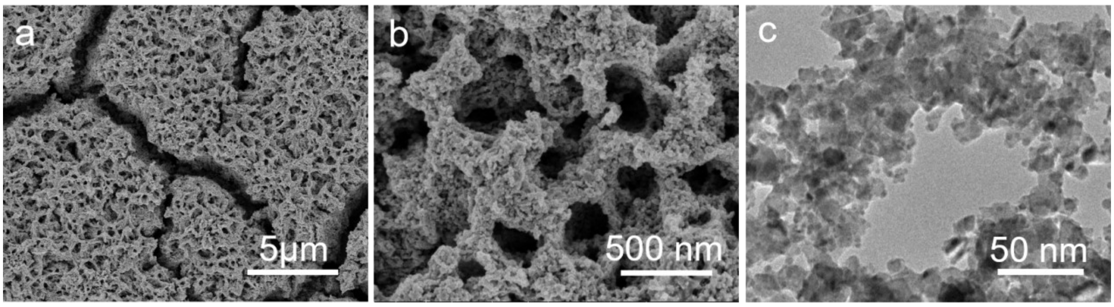

Fig. S3 SEM images of TiO_xN_y NBs.

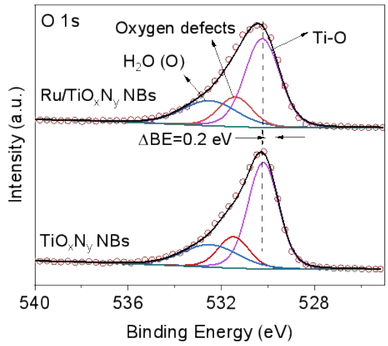

Fig. S4 The XPS spectra of O1s for Ru/TiO_xN_y, TiO_xN_y and Ru/$H_2Ti_2O_5$ NBs.

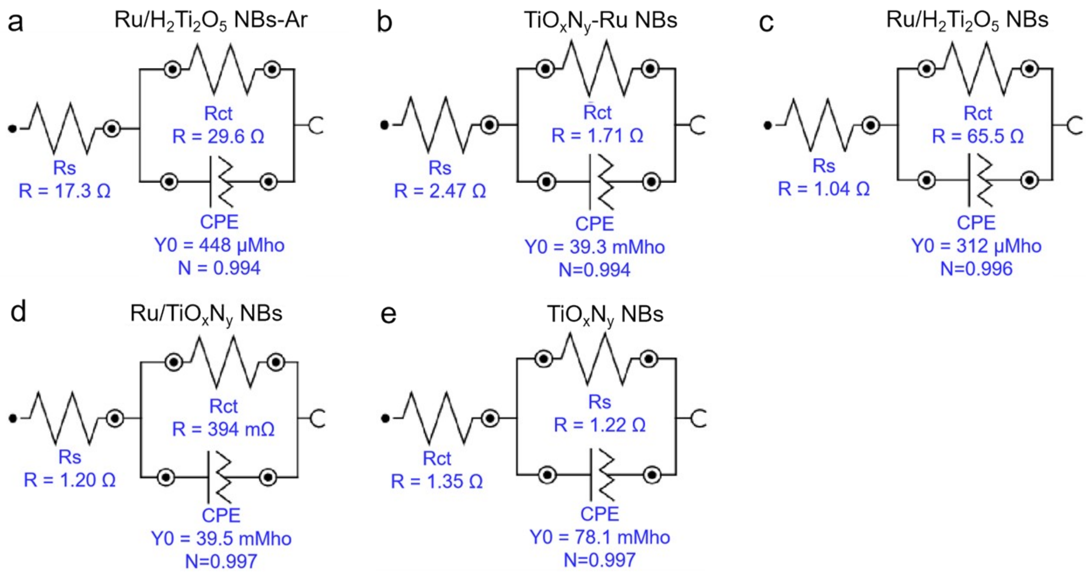

Fig. S5 The equivalent circuits and the fitted Rs and Rct values for Ru/TiO_xN_y NBs and other electrocatalysts.

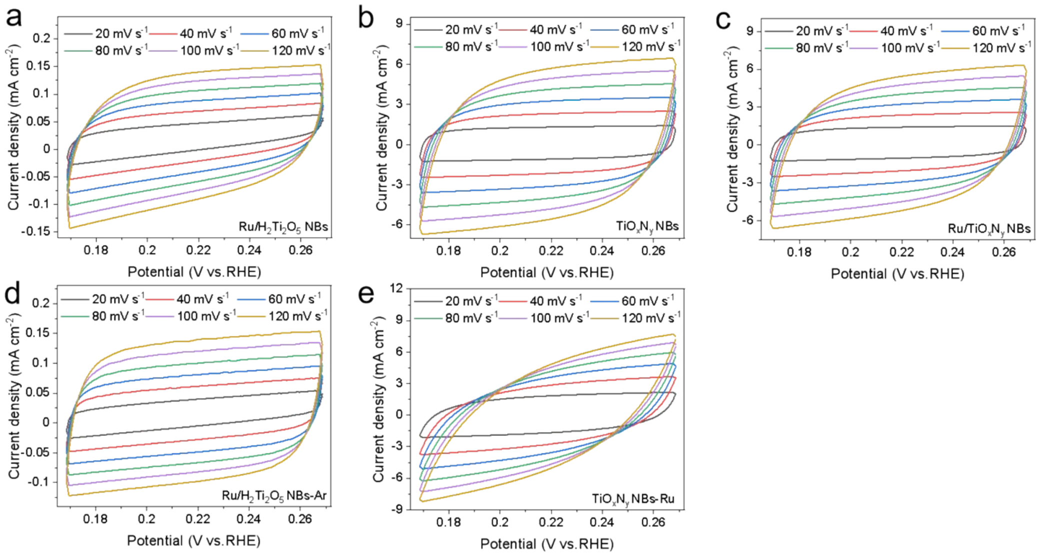

Fig. S6 CV curves of Ru/TiO_xN_y NBs and other electrocatalysts in the non-faradic regions.

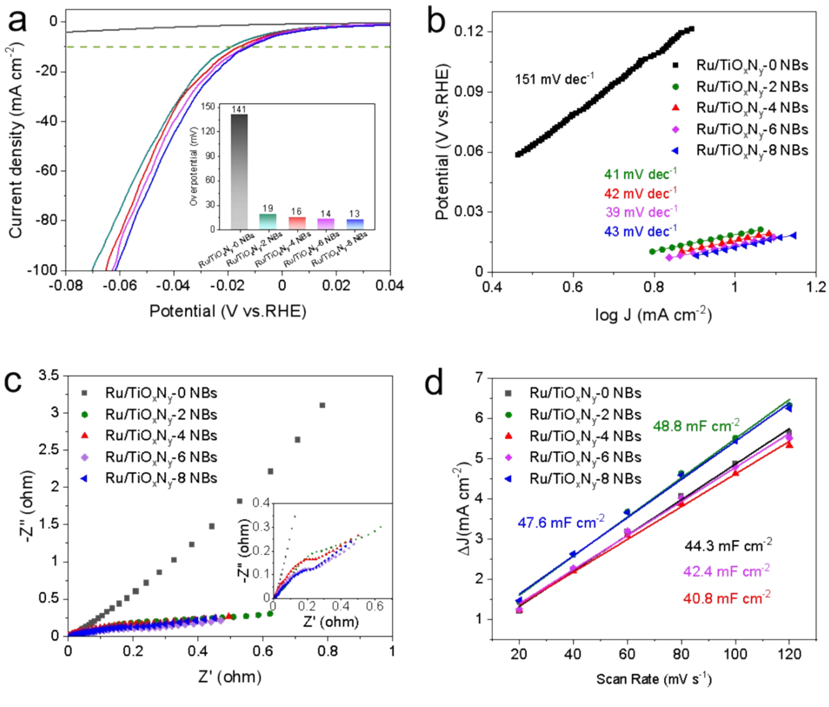

Fig. S7 Electrochemical measurements of Ru/TiO_xN_y-X (X mg, X= 0, 2, 4, 6 and 8) NBs. (a) Polarization curves of as-prepared electrocatalysts in 1 M KOH solution. (b) Tafel plots of these electrocatalysts. (c) The EIS spectra and (d) the C_{dl} calculations of these electrocatalysts.

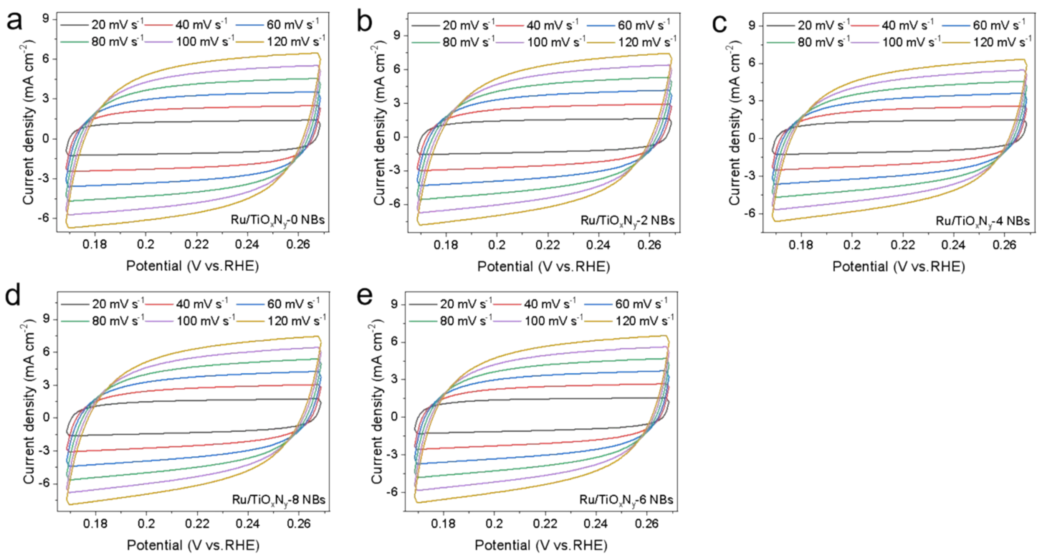

Fig. S8 CV curves of Ru/TiO_xN_y-X (X= mg X= 0, 2, 4, 6 and 8) NBs in the non-faradic regions.

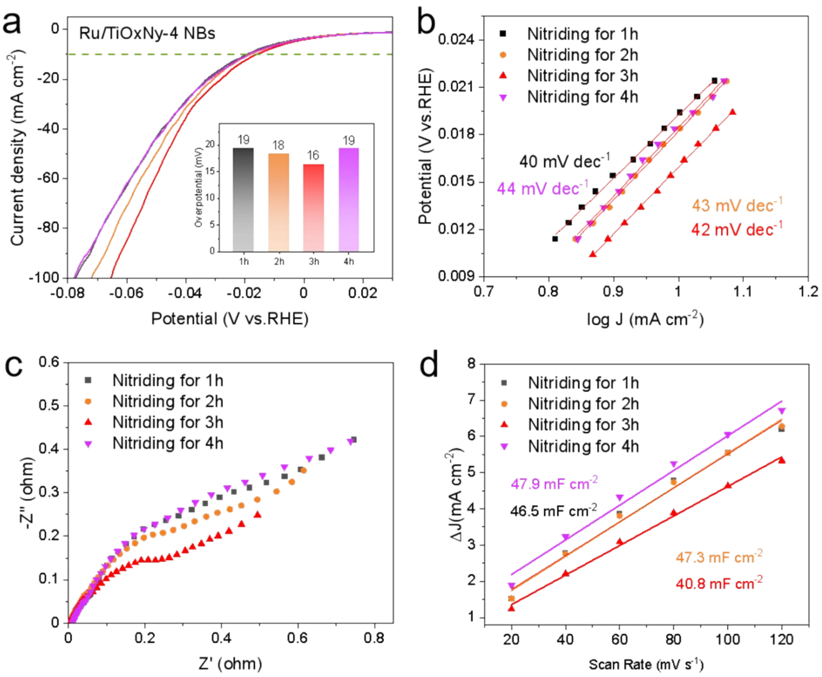

Fig.S9 Electrochemical measurements of Ru/$H_2Ti_2O_5$ NBs with different nitride time (X h, X= 1, 2, 3 and 4 h) NBs. (a) Polarization curves of as-prepared electrocatalysts in 1 M KOH solution. (b) Tafel plots of these electrocatalysts. (c) The EIS spectra and (d) the C_{dl} calculations of these electrocatalysts.

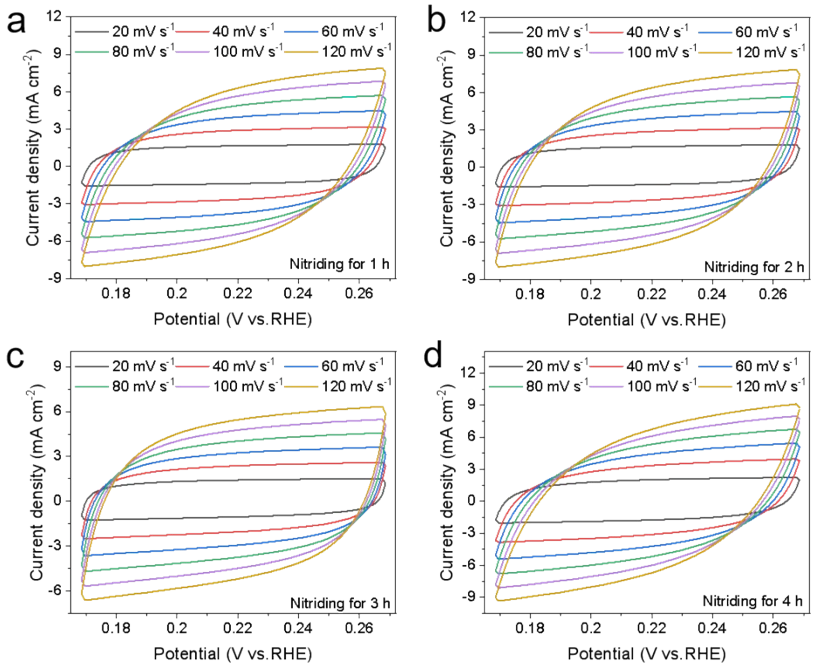

Fig.S10 CV curves of $Ru/H_2Ti_2O_5$ NBs with different nitride time in the non-faradic regions.

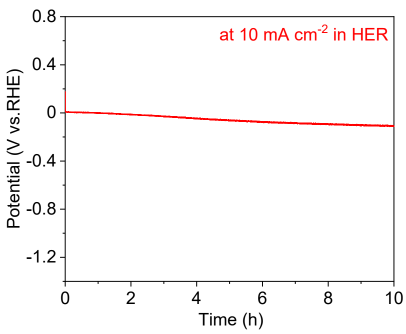

Fig.S11 Long-term stability test of Ru/TiO_xN_y NBs at 10 mA cm^{-2}.

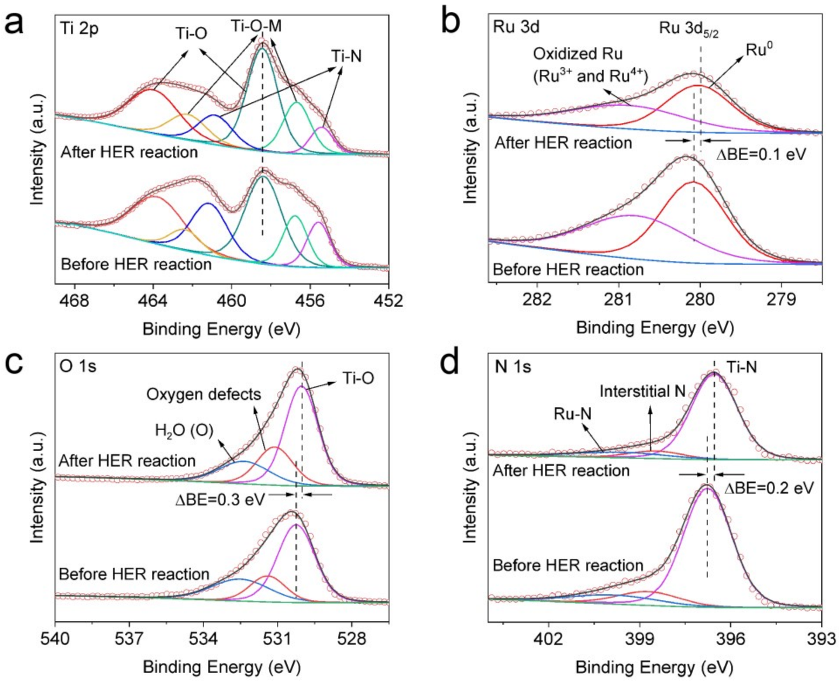

Fig. S12 High-resolution XPS of (a) Ti 2p, (b) Ru 3d, (c) O 1s and (d) N 1s for Ru/TiO_xN_y NBs after stability test.

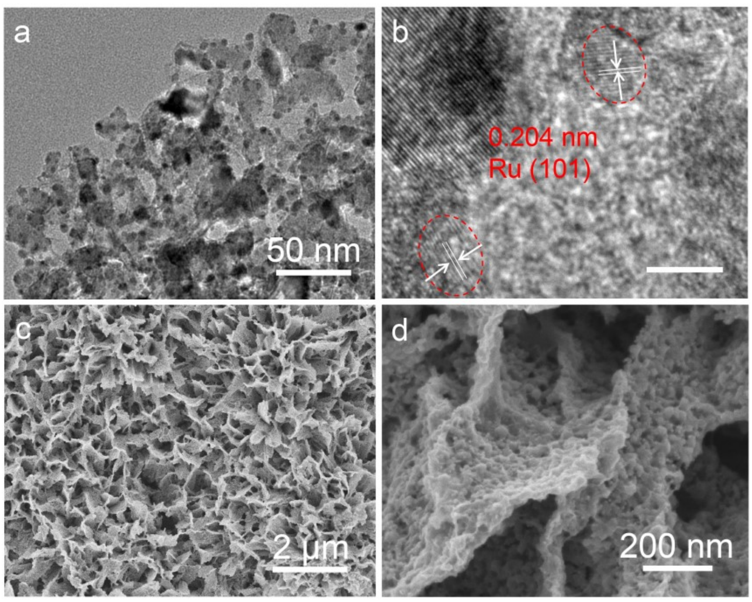

Fig. S13 TEM (a, b) and SEM (c, d) images of Ru/TiO_xN_y NBs after stability test.

Table S1. Comparison of HER performance for some recently reported electrocatalysts in alkaline electrolytes.

Electrocatalysts	Electrolytes	Overpotential (mV)	Tafel slope	Reference
Ru/TiO_xN_y	1.0 M KOH	16 mV at 10 mA cm^{-2}	42 mV dec^{-1}	This work
RuCr@C	1.0 M KOH	19 mV at 10 mA cm^{-2}	24 mV dec^{-1}	1
Ru-CoP/CC	1.0 M KOH	21 mV at 10 mA cm^{-2}	49 mV dec^{-1}	2
Ru@Ni-MOF	1.0 M KOH	22 mV at 10 mA cm^{-2}	40 mV dec^{-1}	3
hybrid RuCoP clusters	1.0 M KOH	23 mV at 10 mA cm^{-2}	37 mV dec^{-1}	4
RuAu SAAs	1.0 M KOH	24 mV at 10 mA cm^{-2}	37 mV dec^{-1}	5
Ru MNSs	1.0 M KOH	24 mV at 10 mA cm^{-2}	~33 mV dec^{-1}	6
Ru_2-GC	1.0 M KOH	25 mV at 10 mA cm^{-2}	65 mV dec^{-1}	7
Ru-MoS_2-Mo_2C/TiN	1.0 M KOH	25 mV at 10 mA cm^{-2}	58 mV dec^{-1}	8
Pt-NC/Ni-MOF	1.0 M KOH	25 mV at 10 mA cm^{-2}	41.2 mV dec^{-1}	9
P-Ru-CoNi-LDH	1.0 M KOH	29 mV at 10 mA cm^{-2}	69 mV dec^{-1}	10
Ru/Co_3O_4	1.0 M KOH	31 mV at 10 mA cm^{-2}	69.8 mV dec^{-1}	11
Ru-$NiCo_2S_4$	1.0 M KOH	32 mV at 10 mA cm^{-2}	41.3 mV dec^{-1}	12
RuRh-Co	1.0 M KOH	32 mV at 20 mA cm^{-2}	31 mV dec^{-1}	13
CC@WS_2/Ru-450	1.0 M KOH	32.1 mV at 10 mA cm^{-2}	53.2 mV dec^{-1}	14
Ru-HMT-MP-7	1.0 M KOH	33 mV at 10 mA cm^{-2}	26.4 mV dec^{-1}	15
RuNi-NCNFs	1.0 M KOH	35 mV at 10 mA cm^{-2}	30 mV dec^{-1}	16
A-CoPt-NC	1.0 M KOH	50 mV at 10 mA cm^{-2}	—	17
Rh/NiFeRh LDH	1.0 M KOH	57 mV at 10 mA cm^{-2}	81.3 mV dec^{-1}	18
Sr_2RuO_4	0.1 M KOH	61 mV at 10 mA cm^{-2}	51 mV dec^{-1}	19
PtO_2-CoOOH/TM	1.0 M KOH	65.1 mV at 70 mA cm^{-2}	39 mV dec^{-1}	20
Ni-MOF@Pt	1.0 M KOH	102 mV at 10 mA cm^{-2}	88 mV dec^{-1}	21
CuPor-RuN_3	1.0 M KOH	114 mV at 10 mA cm^{-2}	—	22
Ru/NiFe LDH-F/NF	1.0 M KOH	115 mV at 10 mA cm^{-2}	87.1 mV dec^{-1}	23
Ni_5P_4-Ru	1.0 M KOH	123 mV at 10 mA cm^{-2}	56.7 mV dec^{-1}	24
Pt_1-Mo_2C-C	1.0 M KOH	155 mV at 10 mA cm^{-2}	92 mV dec^{-1}	25

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