Supporting Information for

Spatial construction of rhodium nanocrystals anchored onto TiO_2-Decorated MXene architectures for enhanced photoelectrocatalytic methanol oxidation

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Supplementary Results

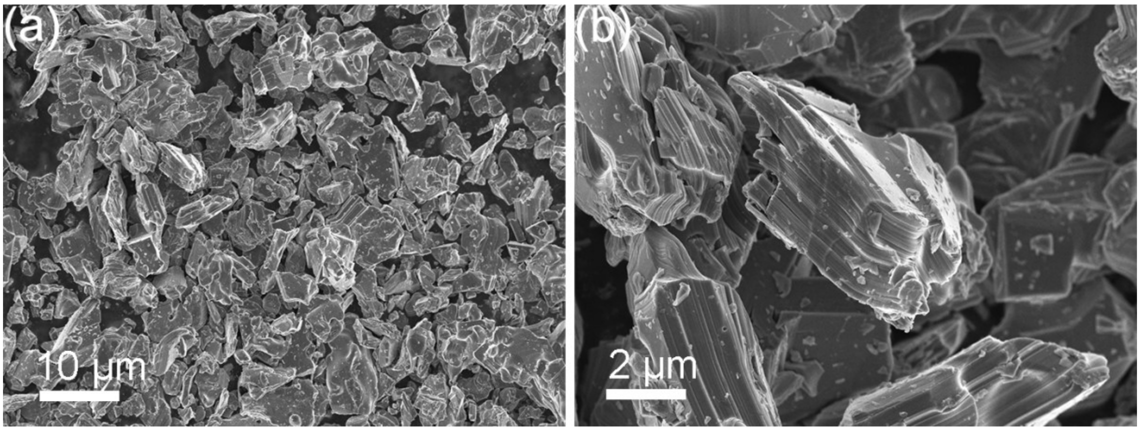

Fig. S1 Representative SEM images of bulk Ti_3AlC_2 at different magnifications

Fig. S2 The Tyndall phenomenon of the as-obtained $Ti_3C_2T_x$ MXene solution

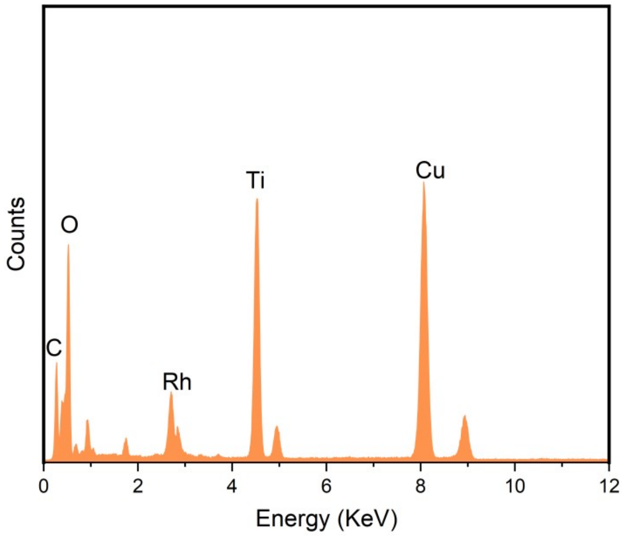

Fig. S3 EDX spectrum of the Rh/TiO_2-MX(24h) catalyst. The Cu signals were also detected because the sample was held on a Cu grid.

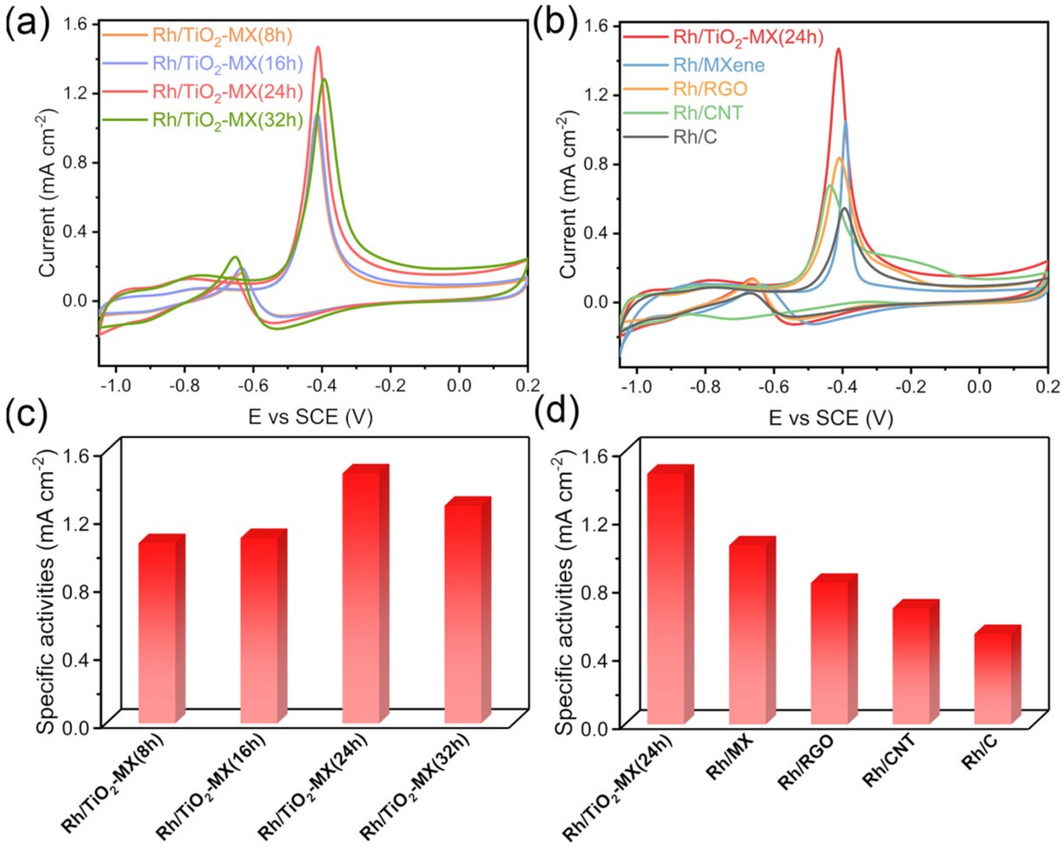

Fig. S4 The ECSA-normalized CV curves of (a) diverse Rh/TiO_2-MX and (b) Rh/MXene, Rh/RGO, Rh/CNT and Rh/C catalysts in 1 M KOH with 1 M CH_3OH solution. (c-d) Specific activities of various catalysts.

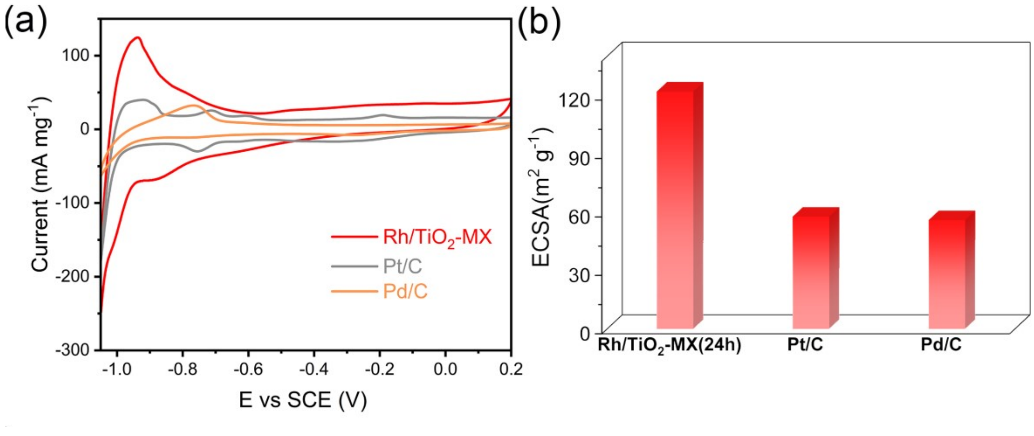

Fig. S5 CV curves of (a) Rh/TiO_2-MX(24h), Pt/C, and Pd/C in 1 M KOH solution at 50 mV s^{-1}. (b) Specific ECSA values of these three catalysts.

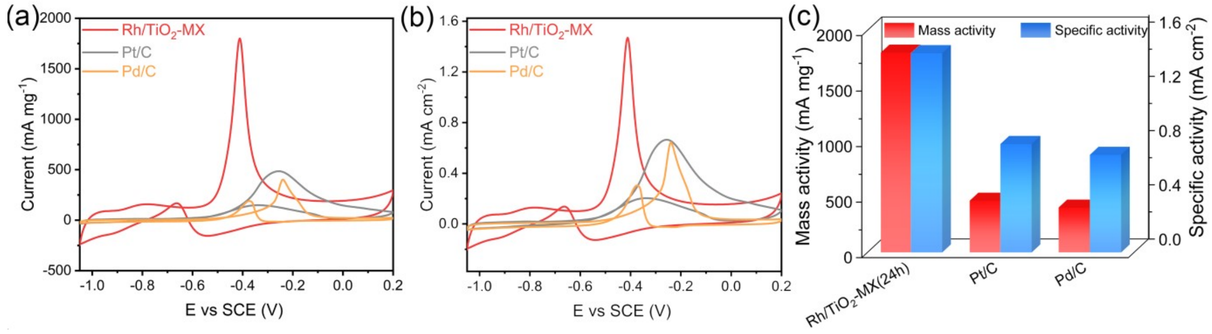

Fig. S6 (a) CV and (b) ECSA-normalized CV curves of Rh/TiO_2-MX(24h), Pt/C, and Pd/C in 1 M KOH with 1 M CH_3OH. (c) Mass and specific activities of these three catalysts.

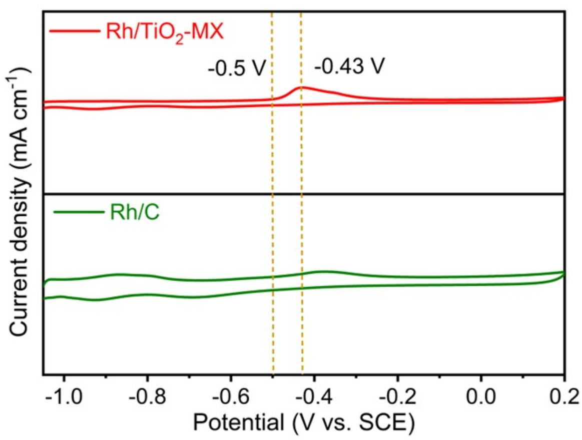

Fig. S7 CO stripping voltammograms for Rh/TiO_2-MX and Rh/C electrodes in 1 M KOH at 50 mV s^{-1}.

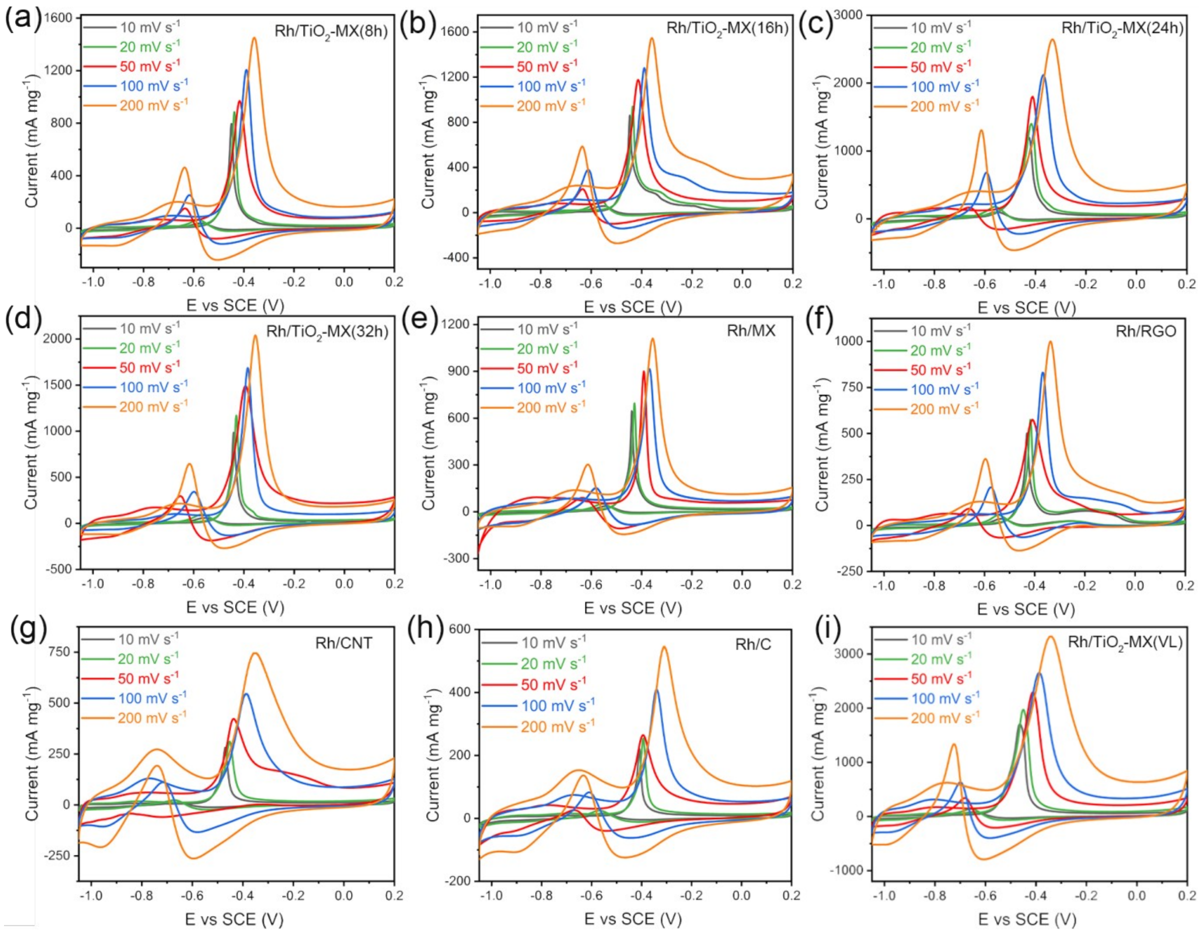

Fig. S8 CV curves of (a) Rh/TiO_2-MX(8h), (b) Rh/TiO_2-MX(16h), (c) Rh/TiO_2-MX(24h), (d) Rh/TiO_2-MX(32h), (e) Rh/MXene, (f) Rh/RGO, (g) Rh/CNT ,(h) Rh/C, and (i) Rh/TiO_2-MX(VL) catalysts recorded at varying scan rates from 10 to 200 mV s^{-1}.

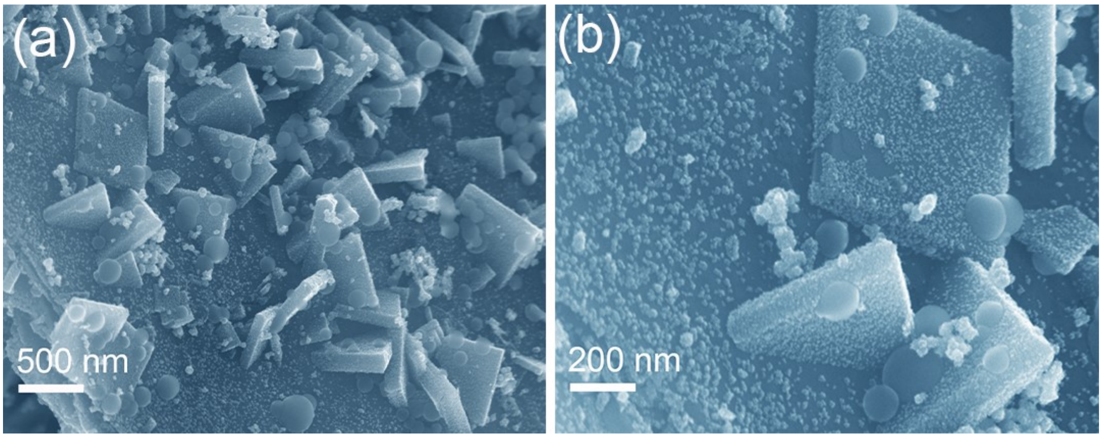

Fig. S9 FE-SEM images of Rh/TiO_2-MX after the long-term stability test.

Table S1 Compiled study comparing CV results for different catalysts.

Catalyst	ECSA (m^2 g^{-1})	Mass activity (mA mg^{-1})	Specific activity (mA cm^{-2})
Rh/TiO_2-MX(8h)	93.1	967.4	1.04
Rh/TiO_2-MX(16h)	108.5	1170.4	1.08
Rh/TiO_2-MX(24h)	122.5	1799.1	1.47
Rh/TiO_2-MX(32h)	116.0	1488.3	1.28
Rh/MX	85.8	897.5	1.05
Rh/RGO	68.6	568.4	0.83
Rh/CNT	62.3	422.6	0.68
Rh/C	48.4	256.8	0.53
Pt/C	57.8	465.1	0.80
Pd/C	56.0	403.3	0.72

Table S2 Comparison of methanol oxidation behavior for the Rh/TiO_2-MX(24h) catalyst and various state-of-the-art Rh-based electrocatalysts.

Catalyst	ECSA (m^2 g^{-1})	Mass activity (mA mg^{-1})	Scan rate (mV s^{-1})	Electrolyte	Ref.
Rh/TiO_2-MX(24h)	122.5	1799.1	50	1 M KOH+ 1 M CH_3OH	This work
Rh/TiO_2-MX(VL)	122.5	2275.0	50	1 M KOH+ 1 M CH_3OH	This work
Rh/MoS_2-RGO	95.5	1502	50	1 M KOH+ 1 M CH_3OH	[S1]
Rh/CNT-RGO	123.8	1228.5	50	1 M KOH+ 1 M CH_3OH	[S2]
Rh/$(BNG)_7$-$(CNT)_3$	105.4	814	50	1 M KOH+ 1 M CH_3OH	[S3]
Rh/$Ti_3C_2T_x$	71.6	600.2	50	1 M KOH+ 1 M CH_3OH	[S4]
Rh/3D graphene	67.3	486.7	50	1 M KOH+ 1 M CH_3OH	[S5]
RhCo bimetallene	70.0	362.2	50	1 M KOH+ 1 M CH_3OH	[S6]
Rh nanosheets	73.1	333	50	1 M KOH+ 1 M CH_3OH	[S7]
Rh nanotubes	60.9	325	50	1 M KOH+ 1 M CH_3OH	[S8]
Hollow Rh spheres	50.7	292	50	1 M KOH+ 1 M CH_3OH	[S9]
Rh nanosheets/RGO	48.7	264	50	1 M KOH+ 1 M CH_3OH	[S10]

Table S3 The charge-transfer resistances (R_{ct}) of different electrodes.

Electrode	R_{ct}	
	Value (ohm)	Error (%)
Rh/TiO_2-MX(24h)	7.5	1.3
Rh/MXene	30.9	1.5
Rh/RGO	40.5	1.4
Rh/CNT	43.7	1.6
Rh/C	5730.2	3.0

Reference

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