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

Subsurface Oxygen Reduction Reaction Activity on Ti_2N MXene Revealed by *In-situ* Raman Spectroelectrochemistry

Eugenie Pranada[1], Denis Johnson[2], Ray Yoo[2], Abdoulaye Djire[1,2*]

[1]Department of Materials Science and Engineering, Texas A&M University, College Station, TX 77843, USA

[2]Artie McFerrin Department of Chemical Engineering, Texas A&M University, College Station, TX 77843, USA

Corresponding Author: adjire@tamu.edu

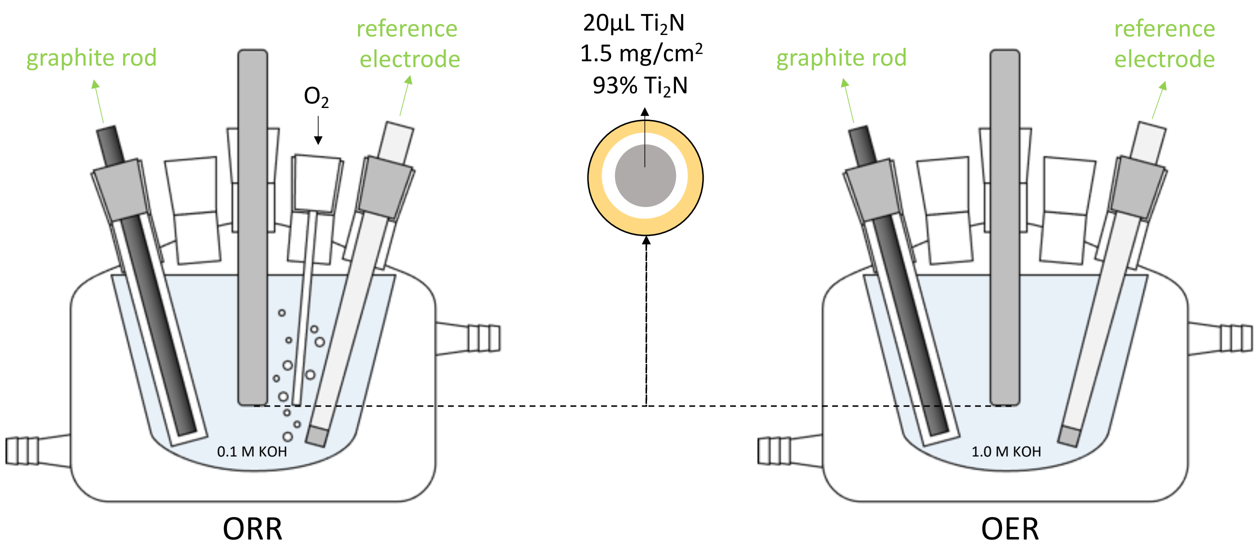

Figure S1. Schematic of the three-electrode electrochemical cell used for the electrochemical measurements.

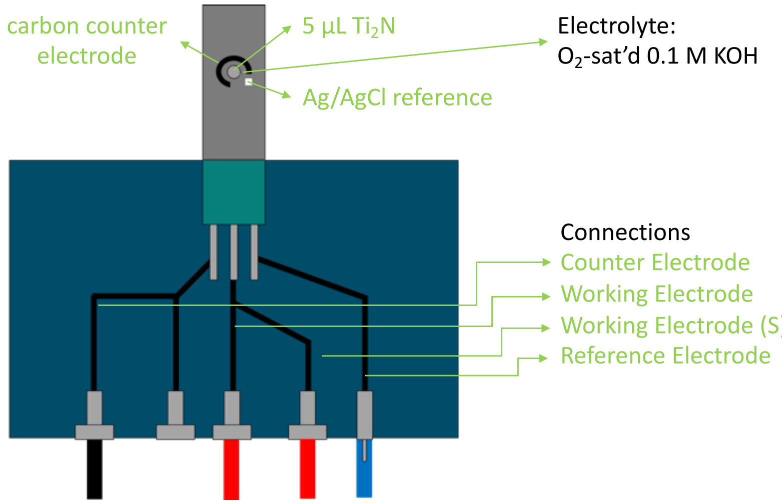

Figure S2. Schematic of the screen-printed cell used for the *in-situ/operando* Raman spectroelectrochemistry.

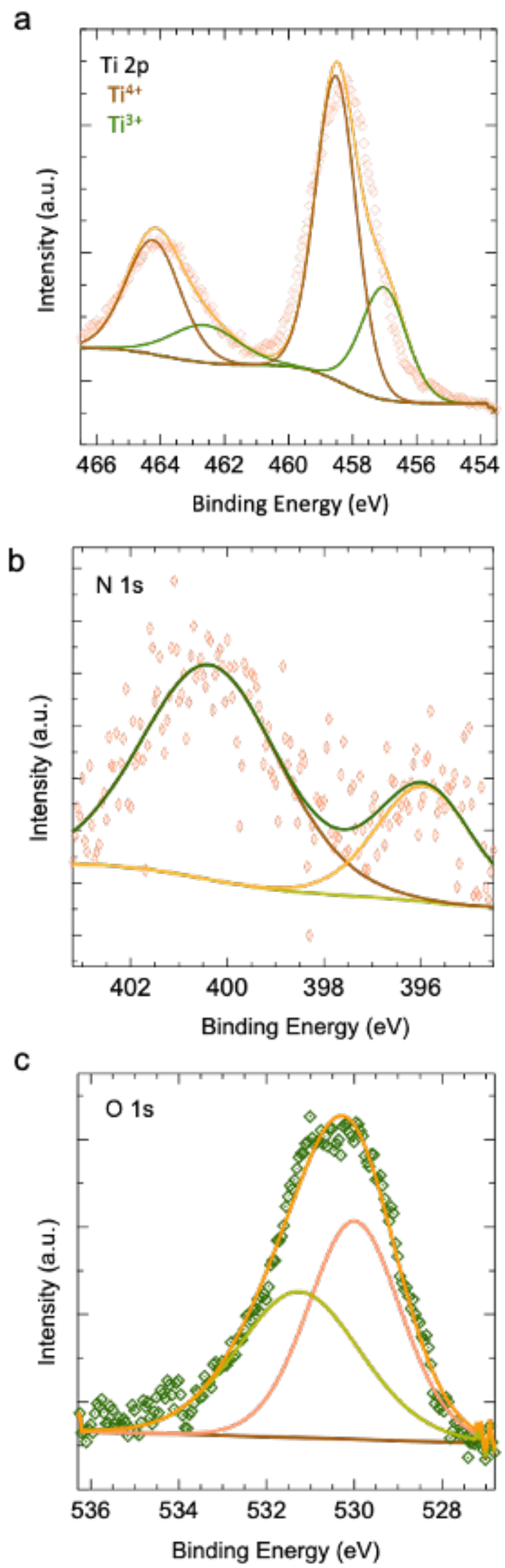

Figure S3. XPS Spectra of pristine Ti_2N Few-layer MXene. a) Ti 2p b) N 1s c) O 1s. The surface chemistry comparison and the passivation layer on the pristine Ti_2N is tracked according to the Ti 2p and O 1s spectra.

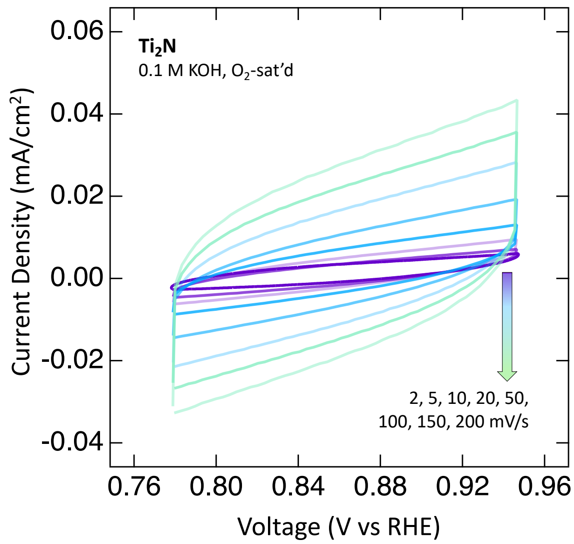

Figure S4. CV of Ti_2N in 0.1 M KOH electrolytic solution. The data are collected at different scan rates to obtain the electrochemical surface area.

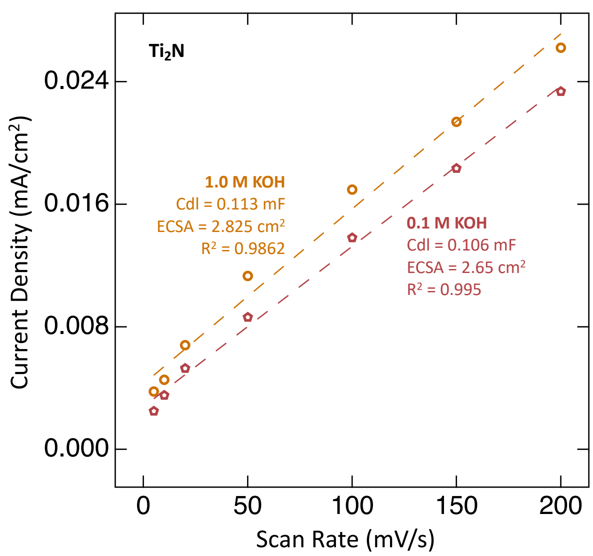

Figure S5. Electrochemical surface area (ECSA) of Ti_2N in 0.1 and 1.0 M KOH electrolytic solutions at 0.86 V vs RHE.

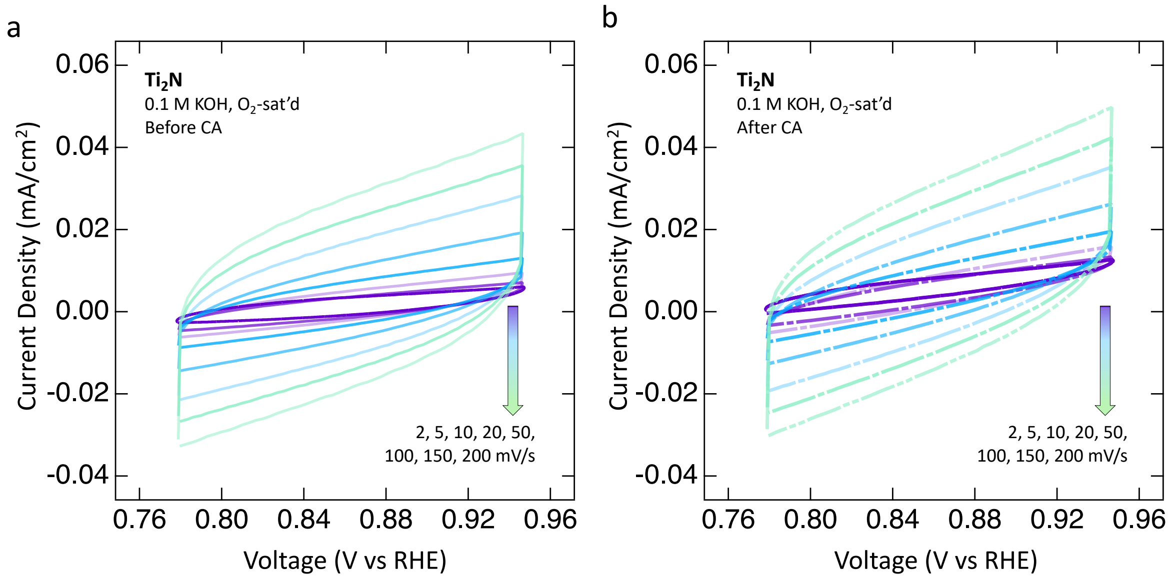

Figure S6. CV of Ti_2N with varying scan rates a) before and b) after CA measurements. Data collected in 0.1M KOH electrolytic solution.

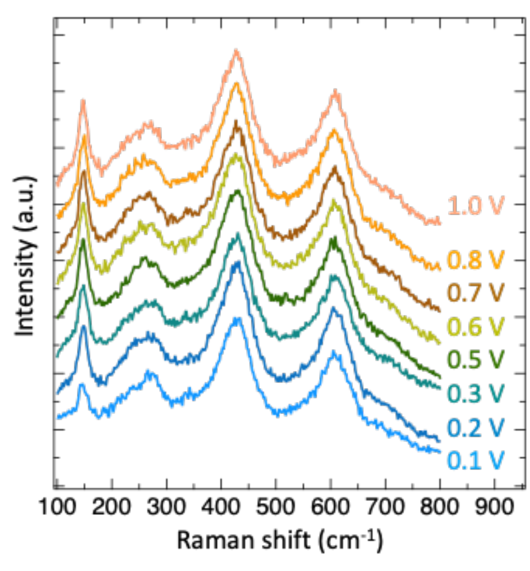

Figure S7. Raman spectra of Ti_2N MXene in O_2-sat'd 0.1 M KOH, taken at 50% laser power.

Table S1. Recent works on ORR in 0.1 M KOH electrolytic solution.

Catalyst	Potential (V vs RHE)		Limiting j (mA/cm^2)	Tafel Slope (mV/dec)	CA or CP test (h), % I/I_0	Ref
	Onset	Half-wave				
10% Pt/C	0.91	0.75	3.2	94.8	4.5, 47.19	This work
Ti_2N	0.70	0.56	1.61	69.3	15, 81.97	This work
Ti_3C_2	0.58	0.50	1.1	104.9	4.5, 54.53	This work
$SrTiO_3/Ti_3C_2$	0.87[a]	0.78	5.63	89.6	5, -	[1]
Co/NCNTs@$Ti_3C_2T_x$	0.936	0.815	5.9	-	5.6, 92.4	[2]
FeCo-N-d-Ti_3C_2	0.96	0.8	5.6	108	5.6, 90+	[3]
MXene@PPy-800	0.85	0.71	4	-	2.2, 86.4	[4]
FePc/$Ti_3C_2T_x$	0.95[a]	0.886	5.5[a]	-	1.4, 74	[5]
Co-CNT/Ti_3C_2-60	0.86[a]	0.82	5.55	63	2.8, 90	[6]
$NiCo_2O_4/Ti_3C_2F_x(OH)_x$	0.85[a]	0.7	5.82	-	-	[7]

a: estimated from graph

References

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