Supporting information

A Step Towards Non-Invasive Diagnosis of Diabetes Mellitus Using In-Situ Synthesized MOF-MXene Hybrid Material with Extended Gate Field-Effect Transistor Integration

Mallikarjuna Swamy Shabanur Matada[a], Rahul S. Ghuge[a], Surya Velappa Jayaraman[b,c], Corrado Di Natale[d*], Yuvaraj Sivalingam[a,e*]

[a]*Laboratory of Sensors, Energy and Electronic devices (Lab SEED), Department of Physics and Nanotechnology, SRMIST, Kattankulathur 603203, Tamil Nadu, India.*

[b]*Novel, Advanced, and Applied Materials (NAAM) Laboratory, Department of Physics and Nanotechnology, SRMIST, Kattankulathur 603203, Tamil Nadu, India.*

[c]*New Industry Creation Hatchery Center (NICHe), Tohoku University, Aoba-ku, Sendai 980-8579, Miyagi, Japan.*

[d]*Department of Electronic Engineering, University of Rome Tor Vergata, Via del Politecnico 1, 00133 Rome, Italy.*

[e]*Computer, Electrical, and Mathematical Sciences and Engineering Division (CEMSE, King Abdullah University of Science and Technology (KAUST), Thuwal 23955-6900, Kingdom of Saudi Arabia.*

* Corresponding author e-mail: Yuvaraj Sivalingam – yuvaraj.sst@gmail.com, yuvaraj.sivalingam@kaust.edu.sa; Corrado Di Natale - dinatale@uniroma2.it

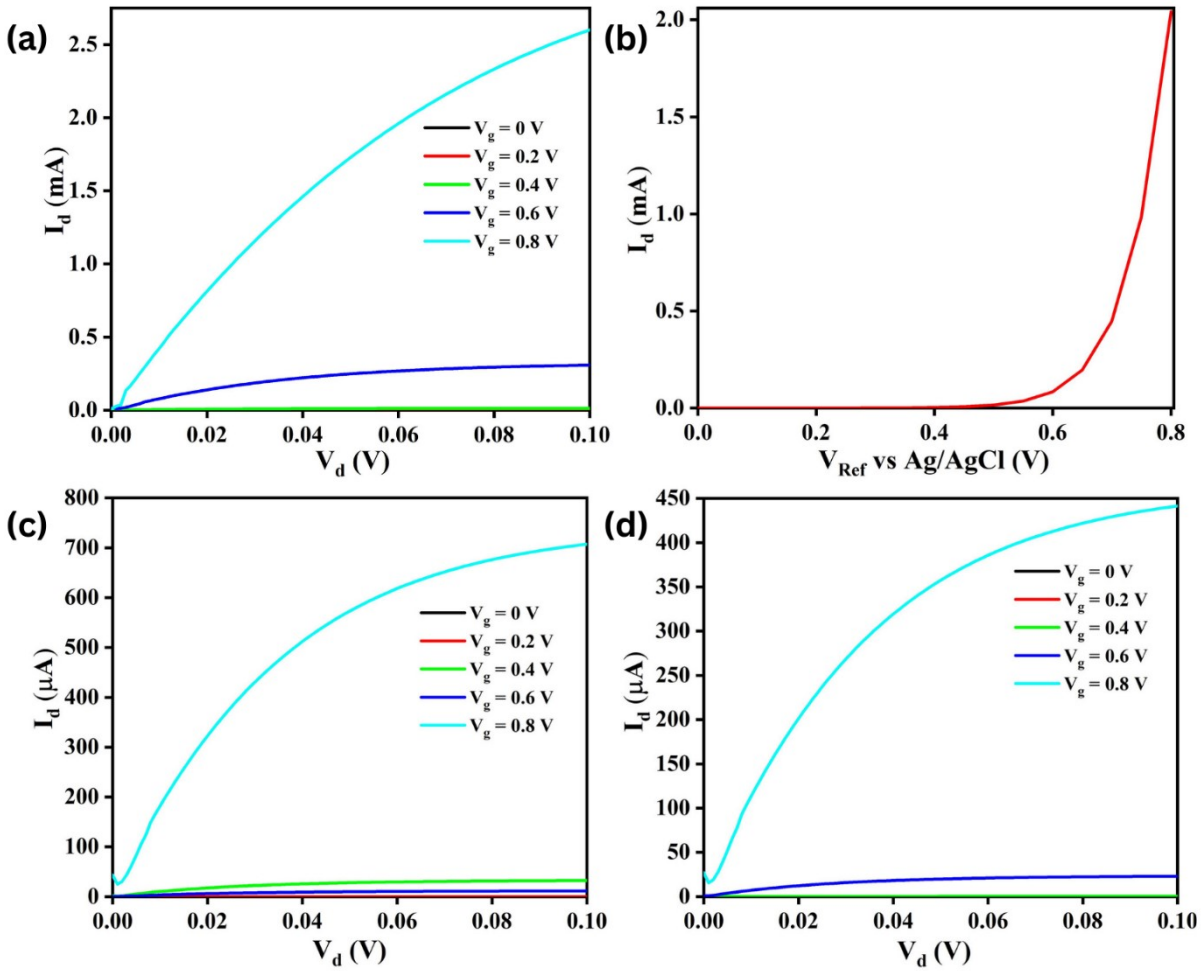


Fig. S1 (a and b): (a) Output curve with V_d in the range from 0 to 0.1 V with the varying V_g from 0 to 0.8 V and (b) Transfer curve obtained by sweeping V_g from 0 to 0.8 V (V_d is 0.1V) of n-MOSFET characteristics; Fig. S1 (c and d): Output curve of MOSFET after extending with $Ni_{BDC\text{-}MXene}$/CP electrode (c) before cycling and (d) after 20 cycles in 1X PBS.

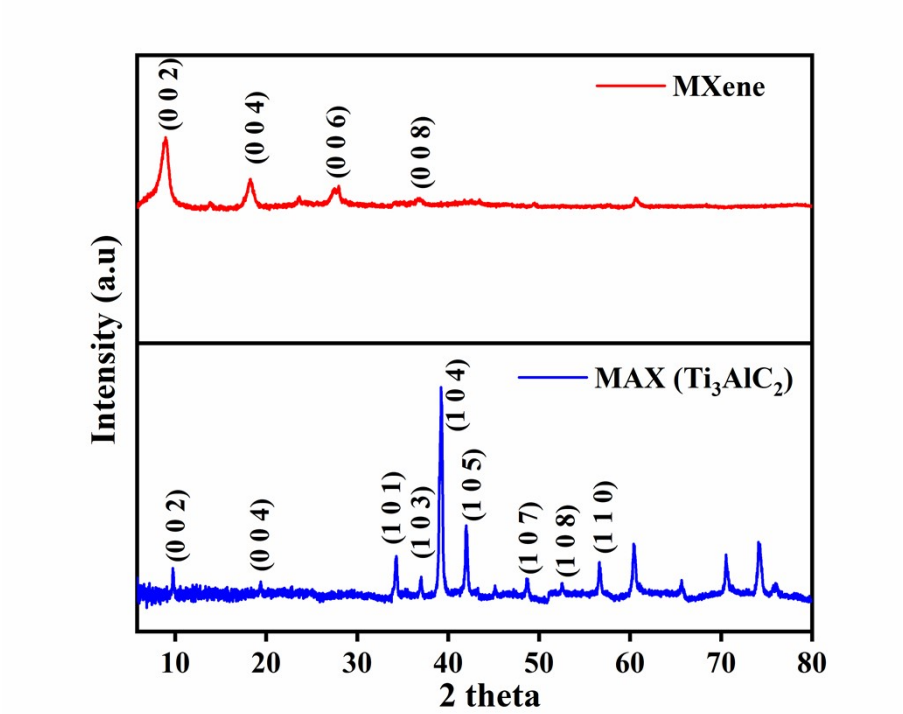


Fig. S2: XRD patterns of MXene ($Ti_3C_2T_x$) and MAX phase (Ti_3AlC_2).

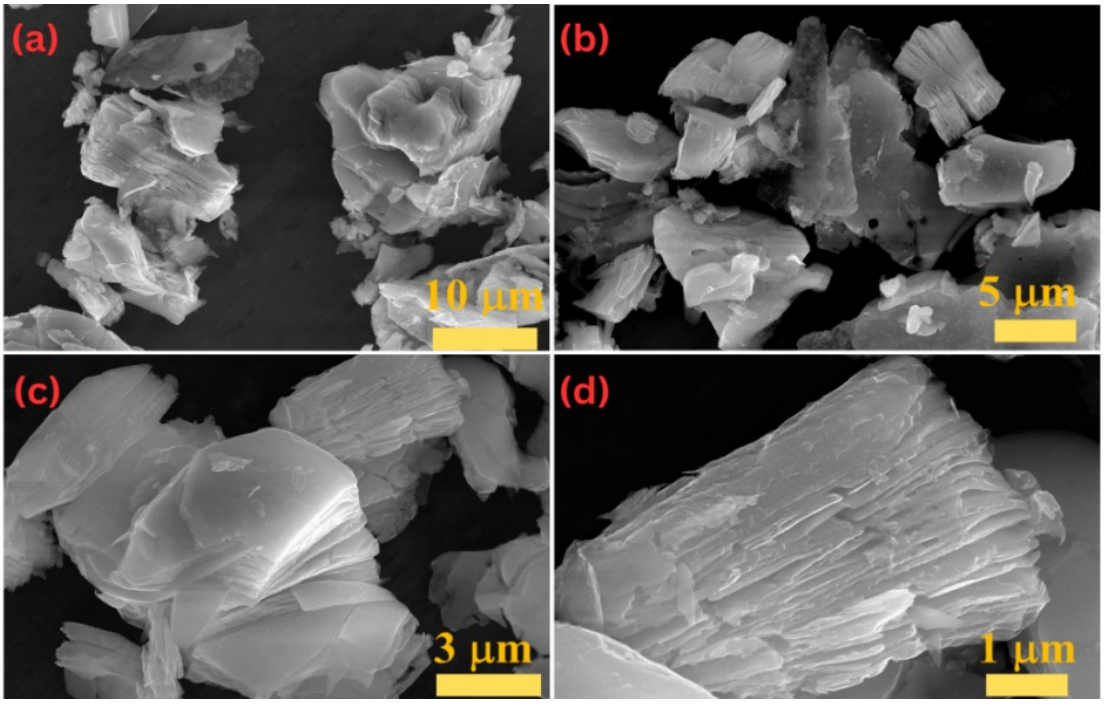
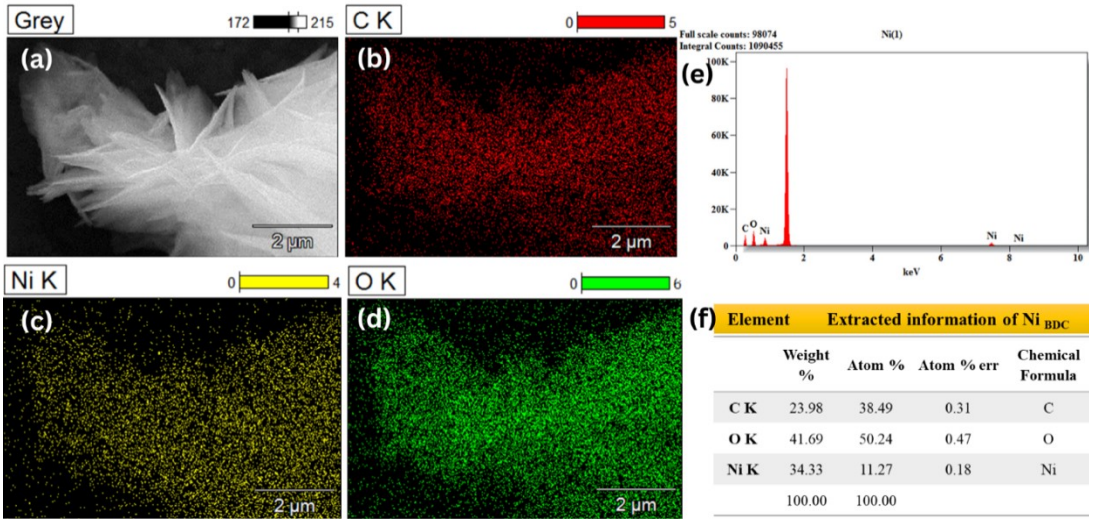


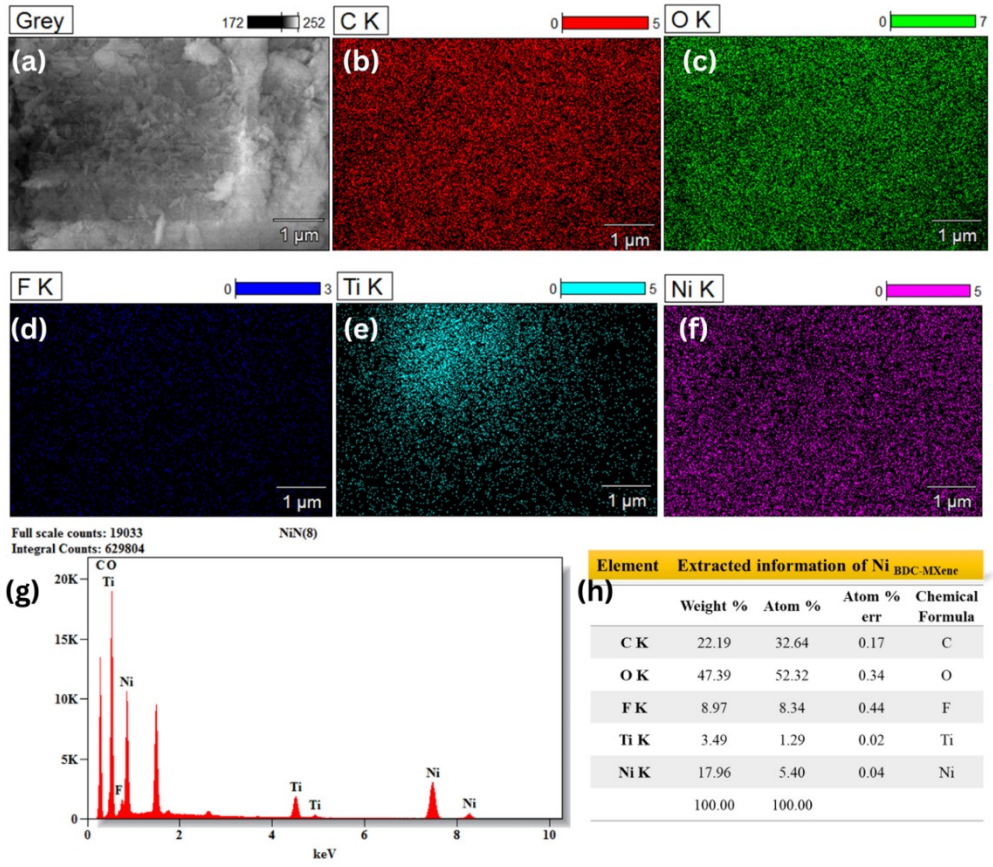
Fig. S3: (a-d) HR-SEM images of $Ti_3C_2T_x$ at 10 µM, 5 µM, 3 µM and 1 µM magnifications.



(f)

Element	Extracted information of Ni_{BDC}			
	Weight %	Atom %	Atom % err	Chemical Formula
C K	23.98	38.49	0.31	C
O K	41.69	50.24	0.47	O
Ni K	34.33	11.27	0.18	Ni
	100.00	100.00		

Fig. S4: (a) HR-SEM image of Ni_{BDC} and its (b-d) elemental colour mapping of C, Ni, and O respectively; (e) EDAX spectrum and (f) information extracted from the EDAX spectrum.



(h)

Element	Extracted information of $Ni_{BDC\text{-}MXene}$			
	Weight %	Atom %	Atom % err	Chemical Formula
C K	22.19	32.64	0.17	C
O K	47.39	52.32	0.34	O
F K	8.97	8.34	0.44	F
Ti K	3.49	1.29	0.02	Ti
Ni K	17.96	5.40	0.04	Ni
	100.00	100.00		

Fig. S5: (a) HR-SEM image of $Ni_{BDC\text{-}MXene}$ and its (b-d) elemental colour mapping of C, O, F, Ti and Ni, respectively; (e) EDAX spectrum and (f) information table extracted from the EDAX spectrum.

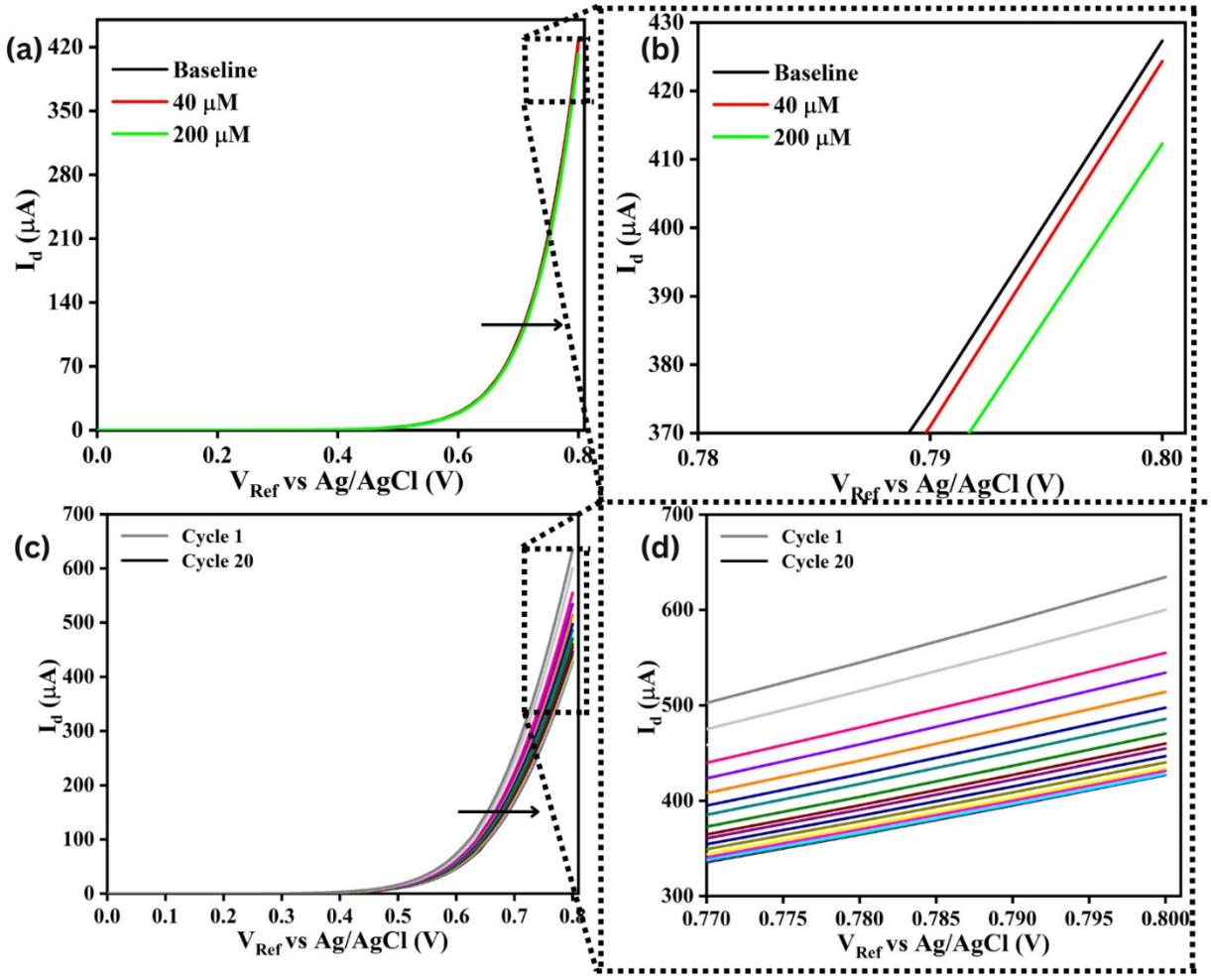


Fig. S6: Transfer characteristics of $Ni_{BDC\text{-}MXene}$/CP (a-b) In the presence different conditions like baseline, in the presence of 40 μM and 200 μM of glucose (c-d) Cyclic stability of $Ni_{BDC\text{-}MXene}$/CP.

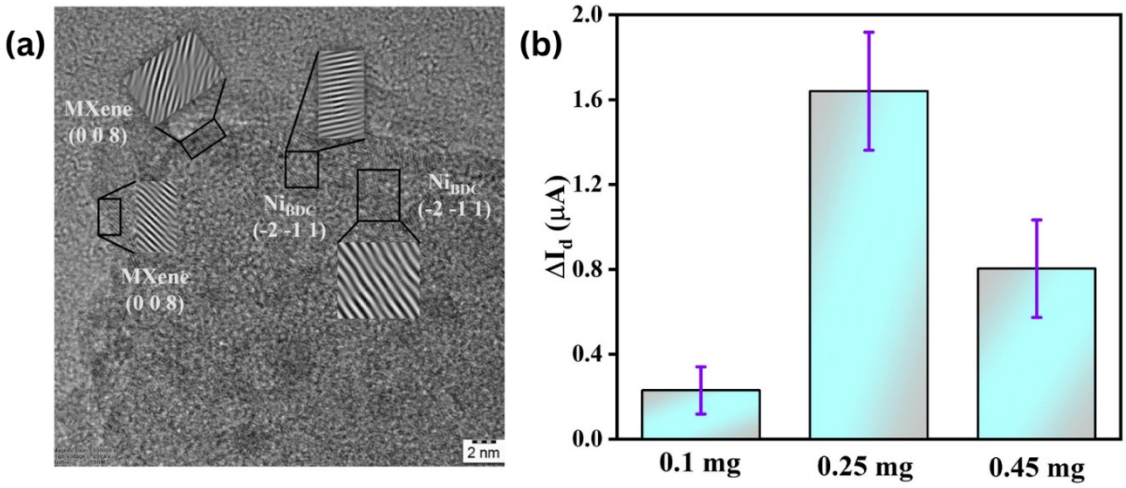


Fig. S7: (a) Lattice fringe pattern of $Ni_{BDC\text{-}MXene}$ obtained from HR-TEM (b) Impact of $Ni_{BDC\text{-}MXene}$ weight loading on carbon paper (CP) towards 10 μM glucose.