Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary Information

Surface Chemistry Altering Electronic Behaviours of Liquid Metal-Derived Tin Oxide Nanosheets

Xiaotian Wei[1], Chung Kim Nguyen[1], Patrick D. Taylor[2], Vaishnavi Krishnamurthi[1], Nitu Syed[1,4], Phuong Y. Le[2], Michelle J.S. Spencer[3], Torben Daeneke[1] and Lei Bao[1]**

[1] School of Engineering, RMIT University, Australia

[2] School of Science, RMIT University, Australia

[3] ARC Centre of Excellence in Future Low-Energy Electronics Technologies,

School of Science, RMIT University, Australia

[4]ARC Centre of Excellence for Transformative Meta-Optical Systems,

The University of Melbourne, Australia

*E-mail: torben.daeneke@rmit.edu.au; lei.bao@rmit.edu.au

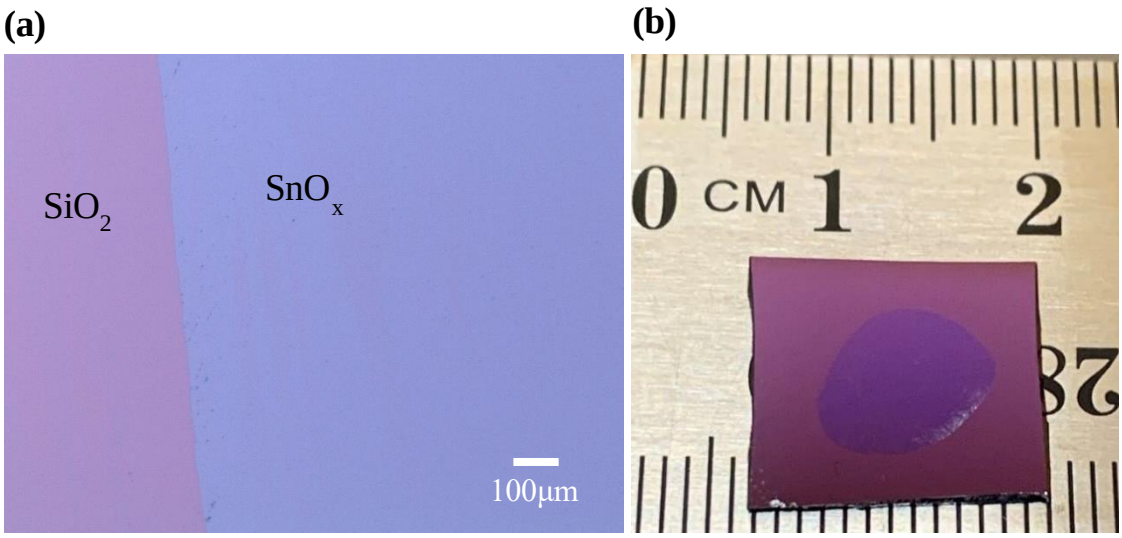

Figure S1. LM technique produced a SnOx nanosheet. (a) An optical microscopy image of obtained pristine SnO_x nanosheet depositing onto 300 nm SiO_2 coated Si substrate. (b) A photo obtained pristine SnO_x nanosheet in 1x1 cm^2 touch printed onto a 300 nm SiO_2 coated Si substrate.

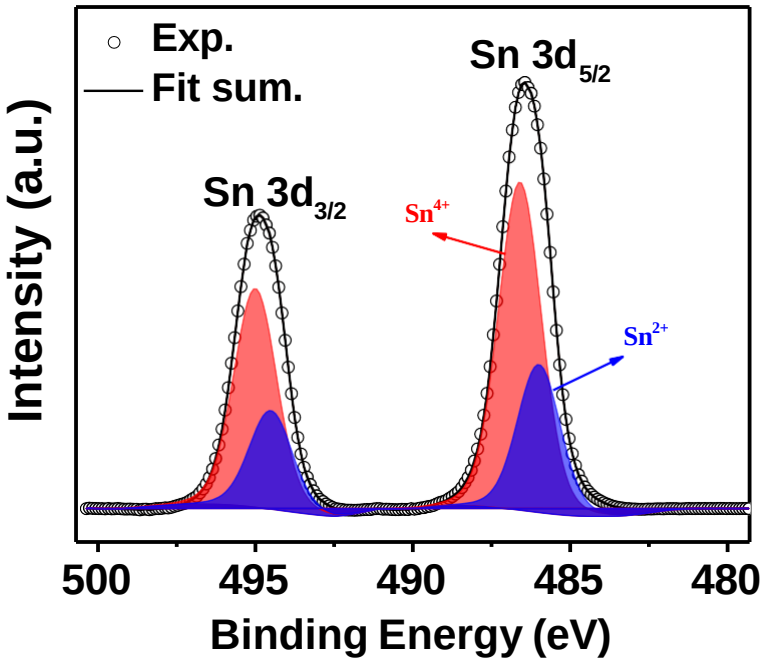

Figure S2. XPS spectra in the Sn 3d region of as-synthesized pristine SnO_x nanosheet.

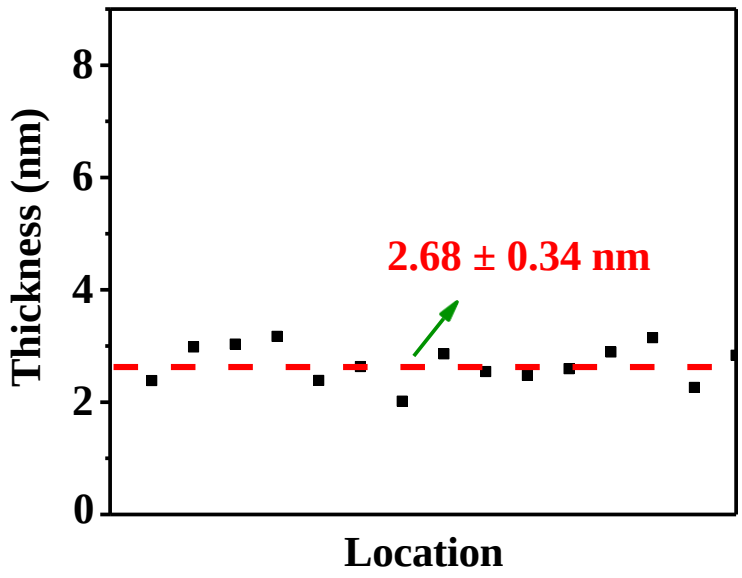

Figure S3. The thickness of the SnO_2 nanosheet dependency on the measured location, indicating the thickness consistency across the sample.

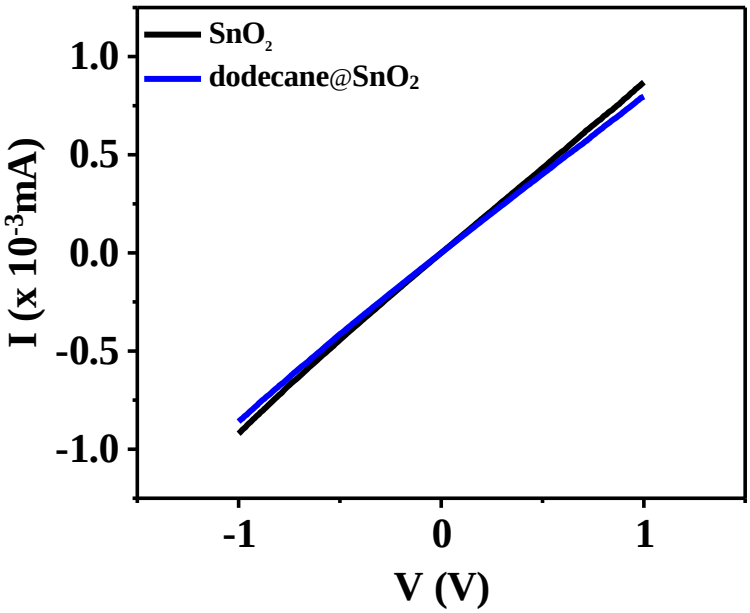

Figure S4. I-V curves of the two-terminal device based on SnO_2 and dodecane@SnO2, respectively.

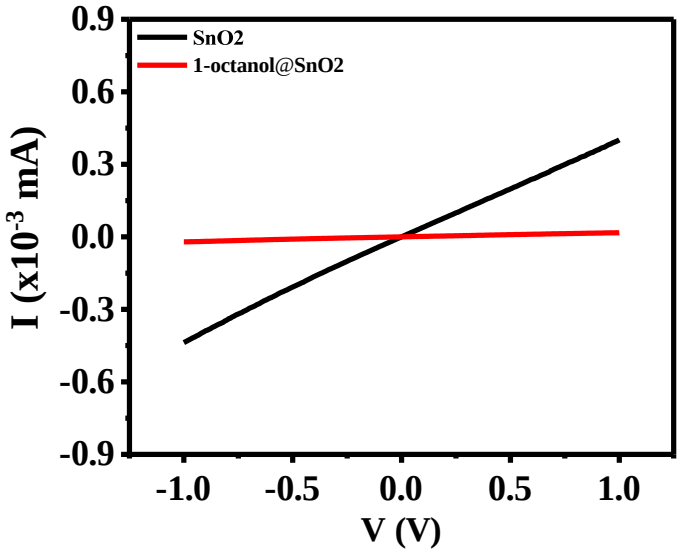

Figure S5. I-V curves of the two-terminal device based on SnO_2 and 1-octanol@SnO_2, respectively.

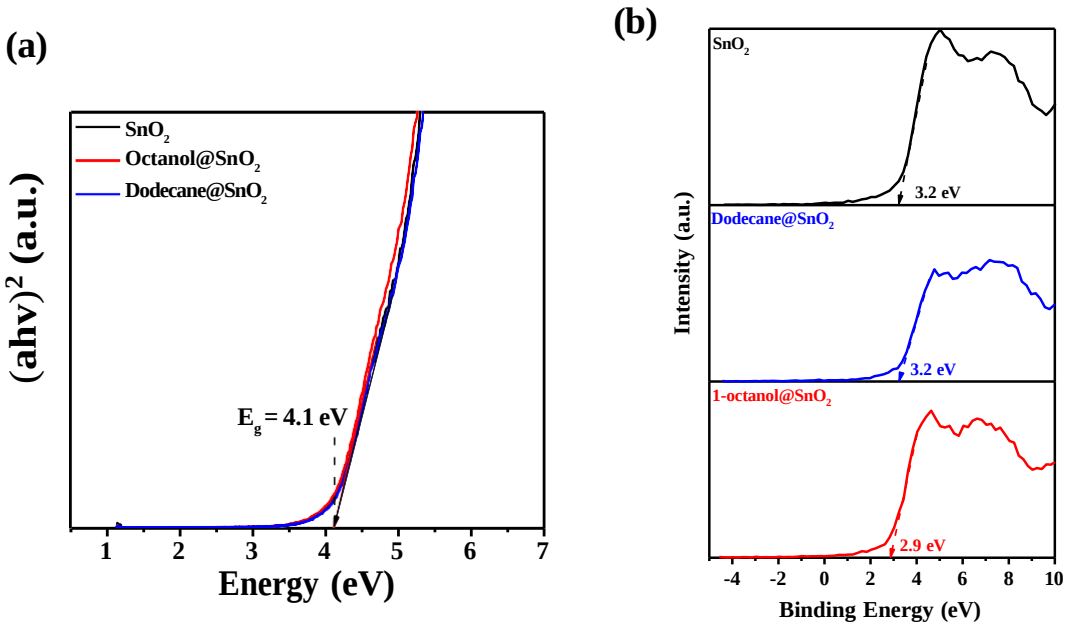

Figure S6. (a) Tauc plot analysis of optical bandgap for SnO_2(black), 1-octanol@SnO_2(red), and dodecane@SnO_2(blue), respectively. (b) XPS valence band (VB-XPS) spectra with the Fermi levels to be 3.2 eV for SnO_2(black), 2.9 eV for 1-octanol@SnO_2(red), and 3.2 eV for dodecane@SnO_2(blue).

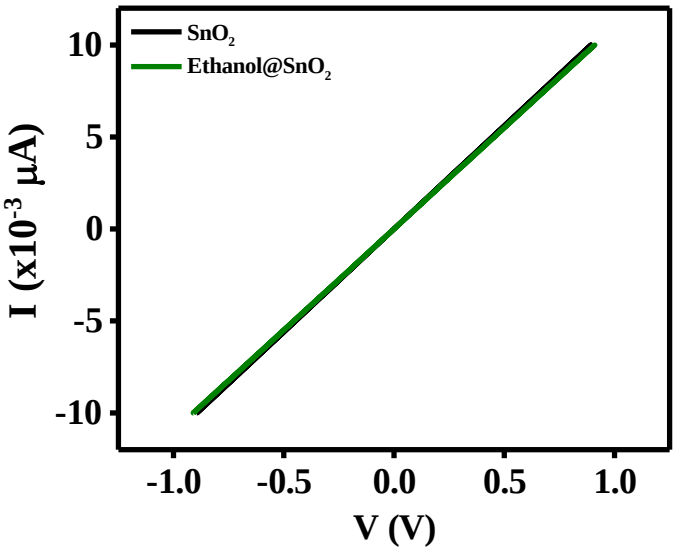

Figure S7. I-V curves of the two-terminal device based on SnO_2 and ethanol@SnO_2, respectively.

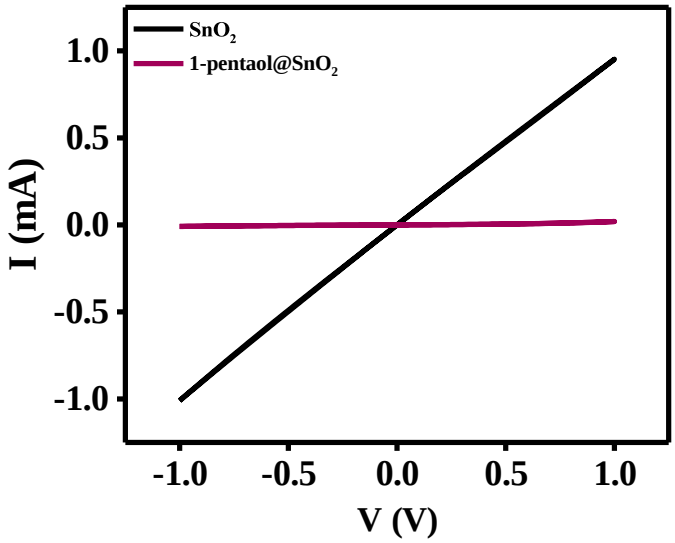

Figure S8. I-V curves of the two-terminal device based on SnO_2 and 1-pentanol@SnO_2, respectively.

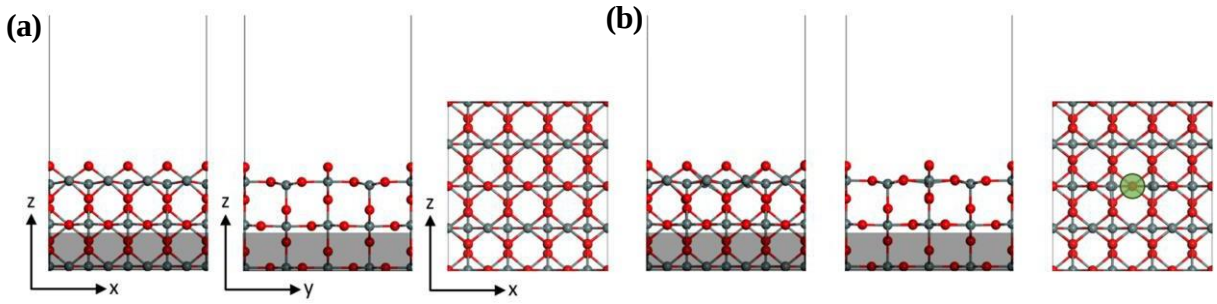

Figure S9. Top and side views of the optimised (a) pristine SnO_2(110) and (b) SnO_2(110)-VO surfaces.

Table S1. Summary of the binding configuration, binding energy and binding distance when the1-octanol molecule interacting with SnO_2 and SnO_2-V_O surface.

Surface	Configuration	BE (eV)	d(O_{ads}-Sn_{sub}) (Å)	d(H_{ads}-O_{sub}) (Å)	d(H_{ads}-O_{ads}) (Å)
SnO_2(110)	p_1	-2.10	2.06	1.02	1.75
	p_2	-1.85	1.44	1.02	1.70
SnO_2(110)-V_O	d_1	-2.24	2.06	1.01	1.77
	d_2	-1.21	2.47, 2.58	-	0.98
	d_3	-1.19	2.53, 2.46	-	0.98
	d_4	-1.07	2.27	-	0.98

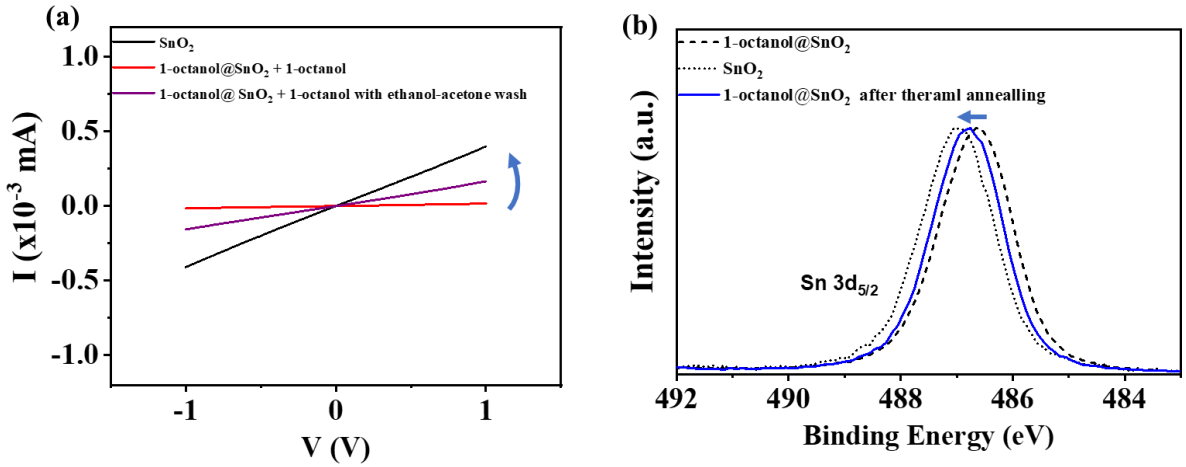

Figure S10. (a) I-V curves of the two-terminal device as indicated samples. (b) XPS of Sn 3d as indicated samples.

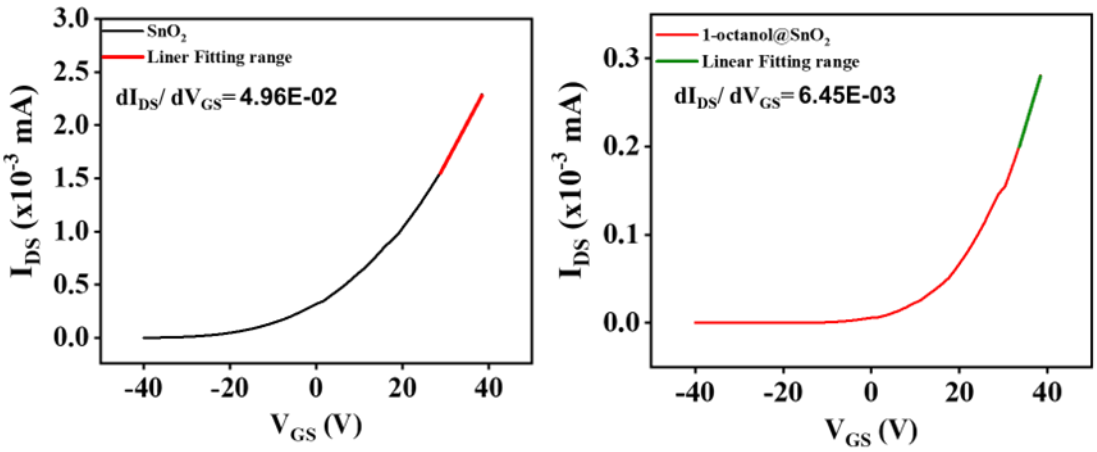

Figure S11. Transfer curves of FET devices of SnO2 and 1-octanol@SnO2. The highlighted regions indicate the fitting region for the corresponding slope of dI_{DS}/ dV_{GS} for electron mobility calculations.