Supporting Information

Wafer-Scale 2D MoS_2 Layers Integrated on Cellulose Substrates Towards Environmentally-Friendly Transient Electronic Devices

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Author Contribution

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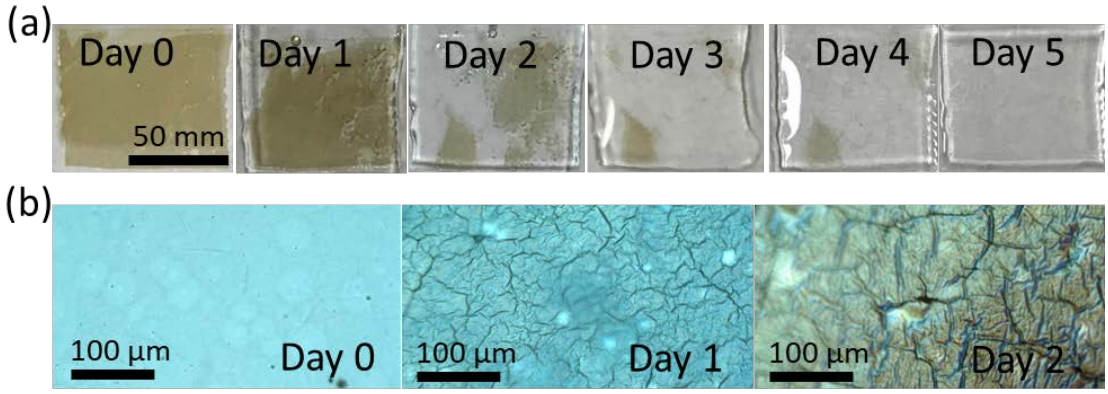

Figure S1. Biodegradable dissolution of 2D MoS_2 layers on a TOCN substrate using the PBS solution. (a) Optical images revealing the time-lapsed dissolution of 2D MoS_2 layers integrated on a TOCN substrate. (b) Enlarged views of the disintegrating 2D MoS_2 layers corresponding to (a).

Figure S2. BSB solution contains $NaHCO_3$, O_2, and H_2O. Likely reactions due to the presence of strong reducing agents such as Na are[1-4]

$$xNa + MoS_2 \rightarrow Na_xMoS_2 \quad (1)$$

$$Na_xMoS_2 + {}_yNa^+ \rightarrow Na_2S + Mo \quad (2)$$

$$MoS_2 + 9/2O_2 + 3H_2O \rightarrow MoO_4^{2-} + 2SO_4^{2-} + 6H^+ \quad (3)$$

Na^+ ions in BSB solution lead to the distortion of 2D MoS_2 layer lattices and the formation of Na_2S (Equation 1 and 2), which will be accelerated by addining more Na^+ ions (Equation 2).[1-4] Eventually, MoS_2 is anticiapted to be oxidized to dissolvable MoO_4^{2-} (Equation 3).[1-4] PBS solution contains disodium hydrogen phosphate (Na_2HPO_4), sodium chloride (NaCl), potassium chloride (KCl), potassium dihydrogen phosphate (KH_2PO_4), O_2, and H_2O. In PBS solution, similar reactions are likely to occur by replacing Na with K in the above equation 1.[1, 2]

Figure S3. Progressive dissolutions of 2D MoS_2 layers integrated on; (a) a paper substrate, and (b) a paper substrate with Au electrode contacts.

For the dissolution of the Au electrodes/2D MoS_2 layers in (b), a buffer solution mixture of vinegar (CH_3COOH) and bleach (NaClO) in a respective volume ratio of 25:1 was prepared.

Proposed reaction: $NaClO + CH_3COOH + Au + MoS_2 \rightarrow NaAuCl_4 + Na_2MoO_4 + Na_2SO_4 + NaC_2H_3O_2 + H_2O + O_2$ at 75 °C.

Supporting Information References

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