Supporting Information

Enhanced Photocatalytic Activity of Titania Nanosheets via Morphology Control and Interface Engineering

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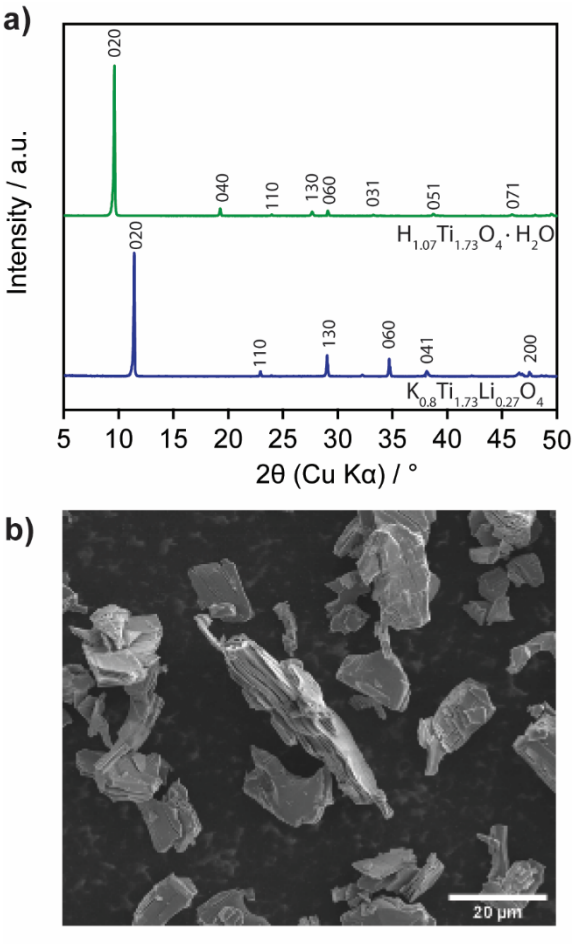


Figure S1. (a) Powder XRD patterns of $K_{0.8}Ti_{1.73}Li_{0.27}O_4$ and protonated $H_{1.07}Ti_{1.73}O_4{\cdot}H_2O$ as a precursor to the $Ti_{0.87}O_2$ nanosheets and (b) SEM image of the $H_{1.07}Ti_{1.73}O_4{\cdot}H_2O$.

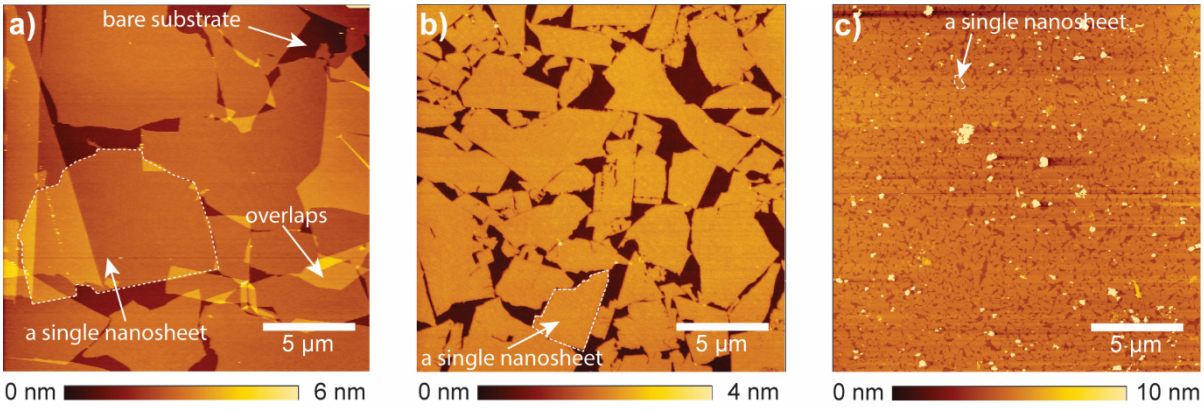


Figure S2. AFM images of the (a) Large, (b) Medium, and (c) Small $Ti_{0.87}O_2$ nanosheets deposited on Si substrates.

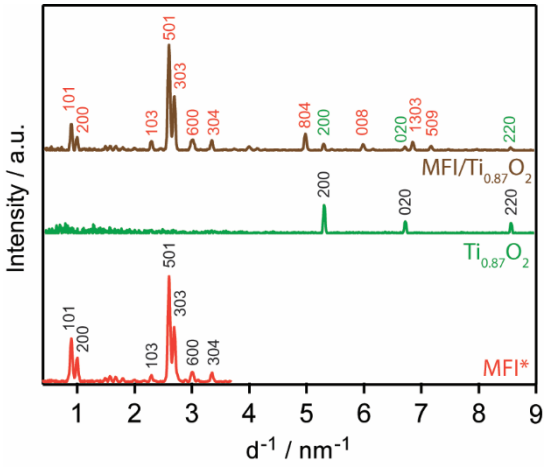


Figure S3. In-plane XRD patterns of monolayer films of $Ti_{0.87}O_2$ and MFI nanosheets and bilayer films composed of MFI nanosheets on top of $Ti_{0.87}O_2$ nanosheets. (*Measurement was terminated at d^{-1} = 3.7 nm^{-1}).

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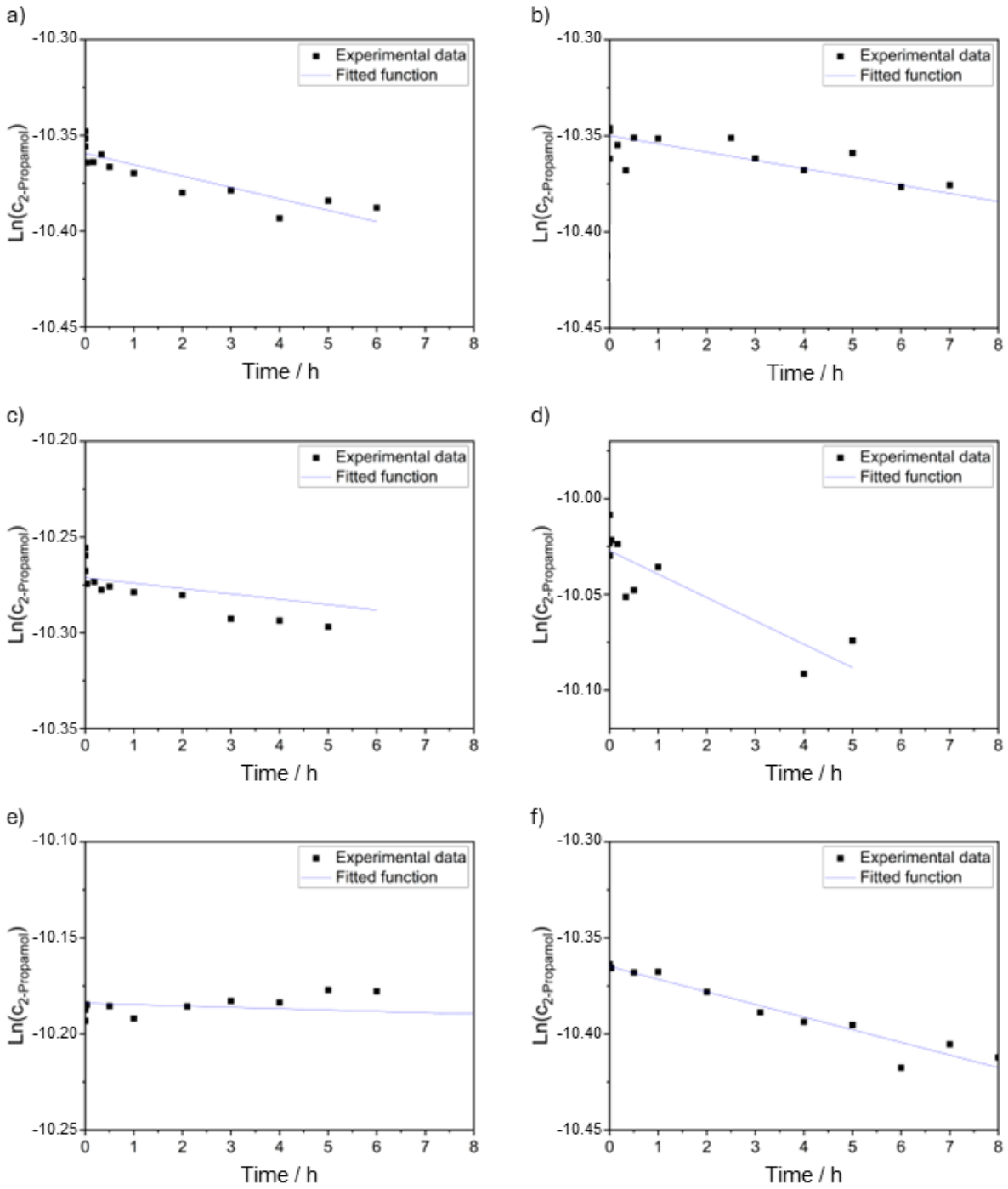


Figure S4. Molar concentration of 2-propanol (logarithmic scale) as a function of time for a) Large, b) Medium, c) Small, and d) sectioned $Ti_{0.87}O_2$ nanosheets deposited on Si wafers, e) Medium nanosheets deposited on ITO glass, and f) on quartz glass substrates. Slope of the fitted line corresponds to the initial reaction rate constant.

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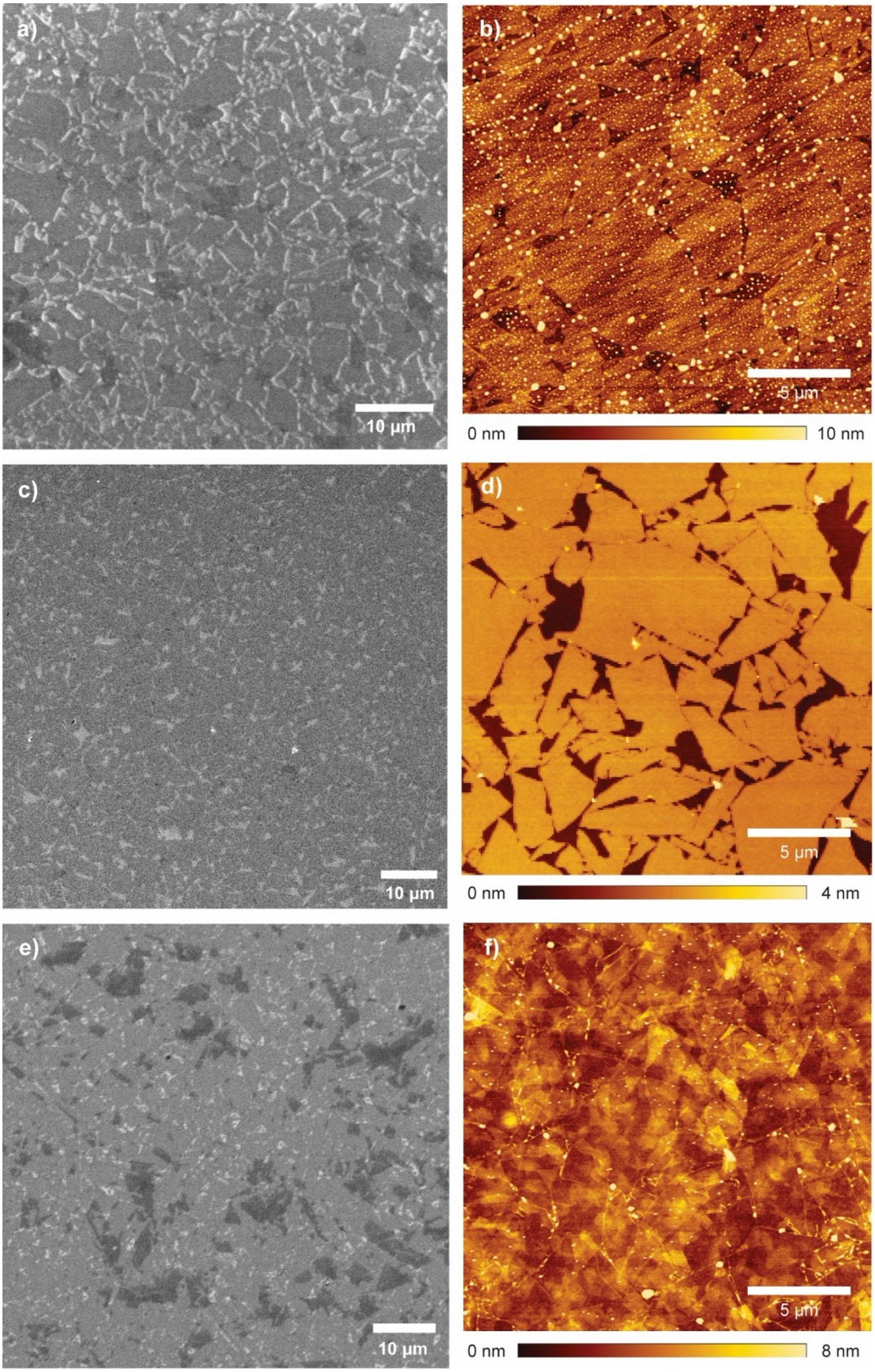


Figure S5. SEM and AFM images of the Medium $Ti_{0.87}O_2$ nanosheets deposited on (a, b) quartz glass, (c, d) Si, and (e, f) ITO glass substrates.

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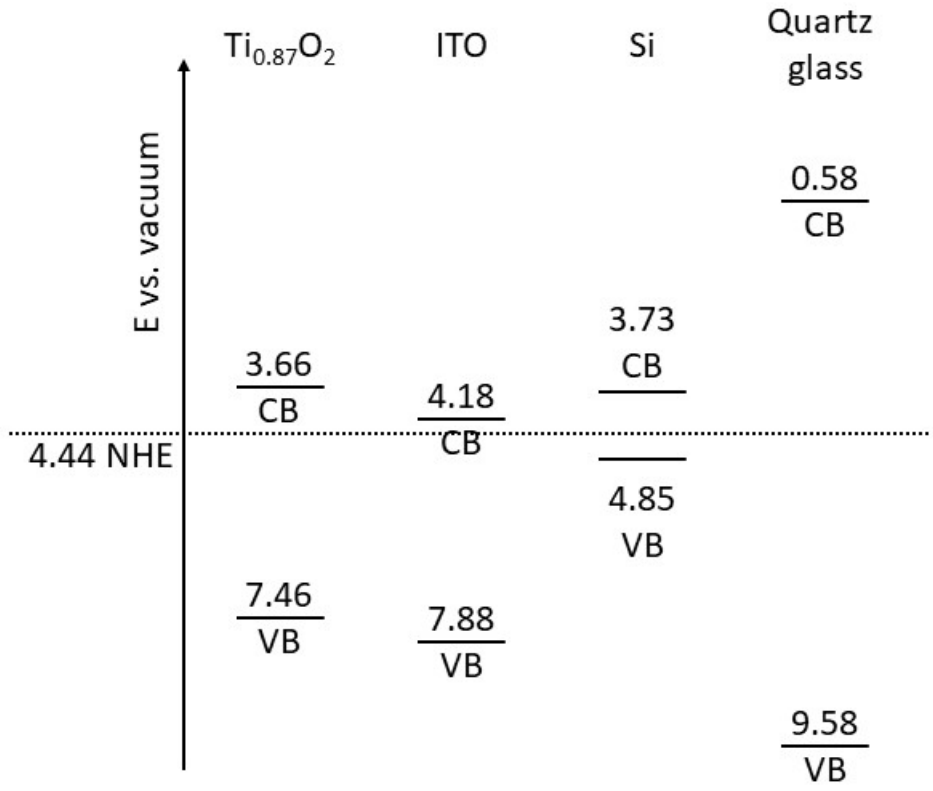


Figure S6. Schematic illustration of electronic band structure of $Ti_{0.87}O_2$ nanosheets, ITO, Si, and quartz glass. The conduction band minimum (CB) and valence band maximum (VB) are provided as potentials relative to the vacuum level.

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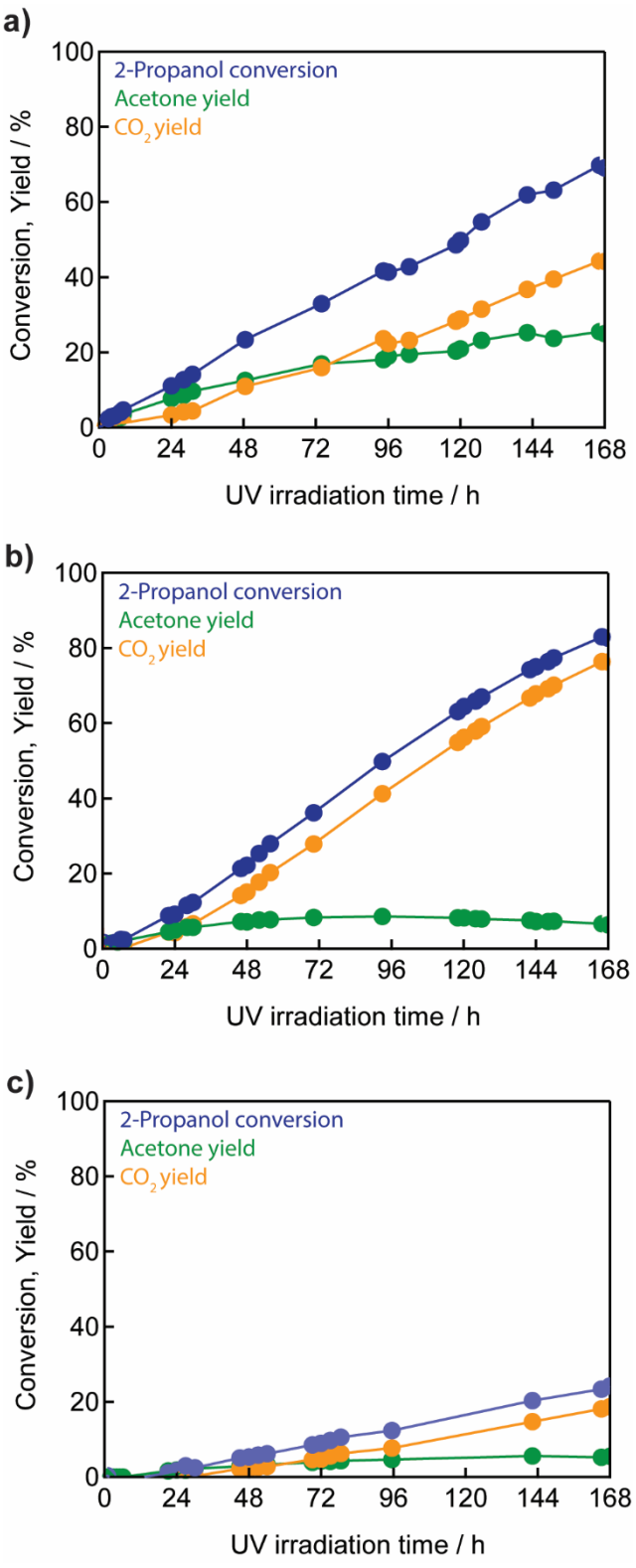


Figure S7. Time course of conversions of 2-propanol and yields of acetone and CO_2 over monolayer films of Medium $Ti_{0.87}O_2$ nanosheet deposited on (a) quartz glass, (b) Si, and (c) ITO glass substrates under UV irradiation.

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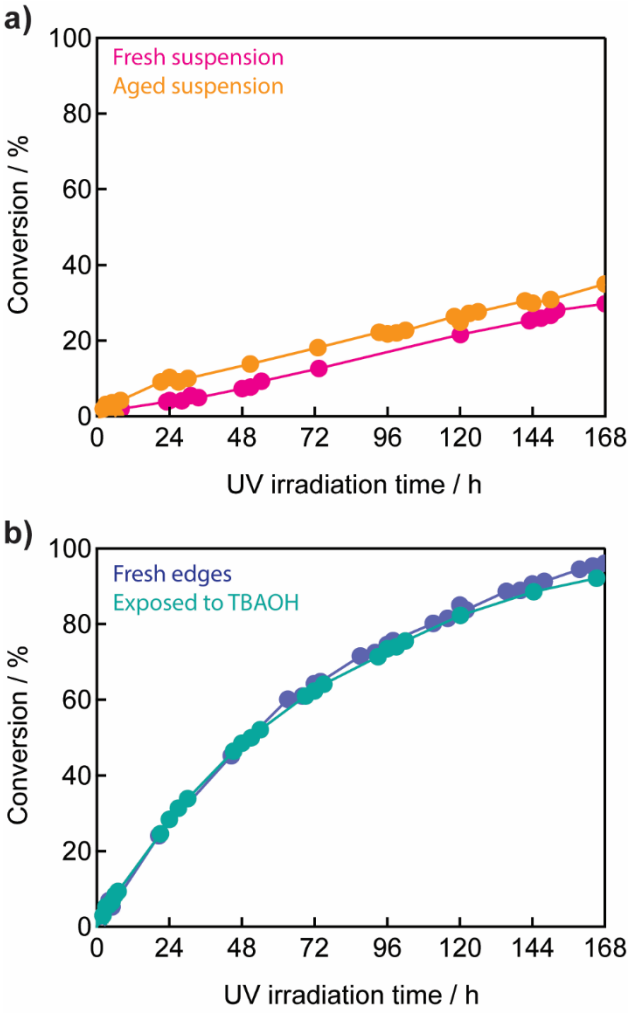


Figure S8. Time course of photocatalytic conversion of 2-propanol over (a) Small $Ti_{0.87}O_2$ nanosheet films prepared from fresh and aged nanosheet suspensions, and (b) films of sectioned $Ti_{0.87}O_2$ nanosheets with freshly generated edges and edges exposed to a TBAOH solution.

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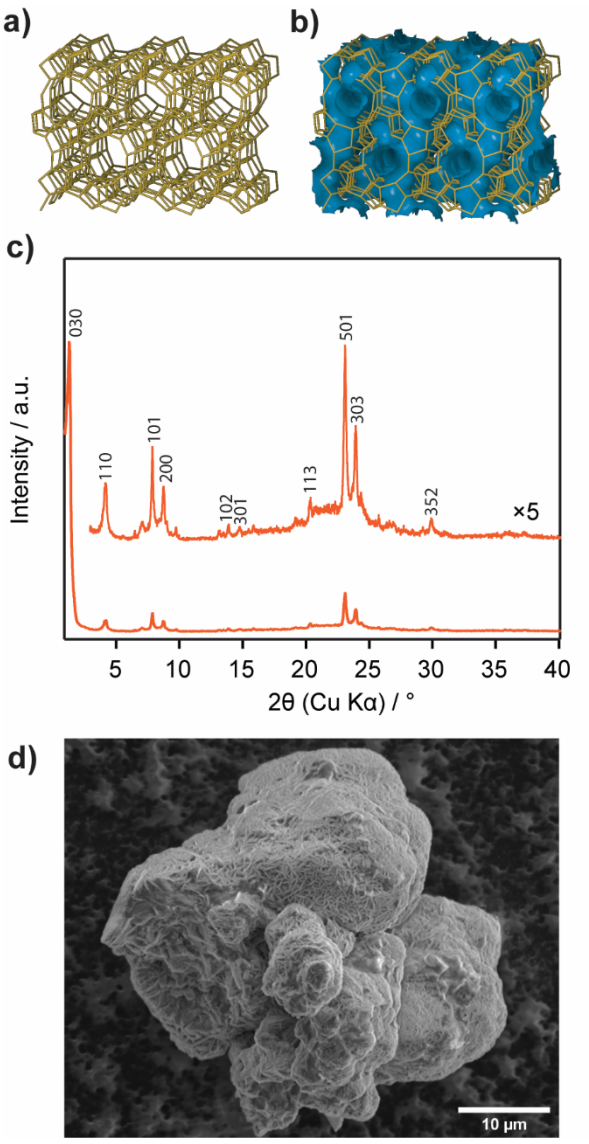


Figure S9. (a) Structure of the MFI zeolite, (b) with highlighted channel system, (c) powder XRD pattern, and (d) SEM image of the as-synthesized layered MFI.

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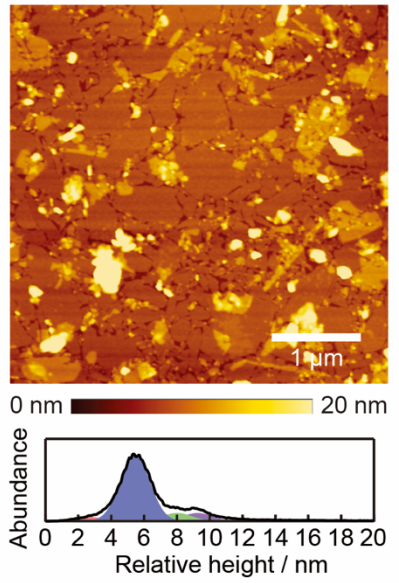


Figure S10. AFM image of a monolayer film of MFI zeolite nanosheets deposited on a Si substrate and the corresponding height histogram deconvoluted into exposed substrate (red), monolayer (blue), overlapped region (green), and non-exfoliated fragments (purple).

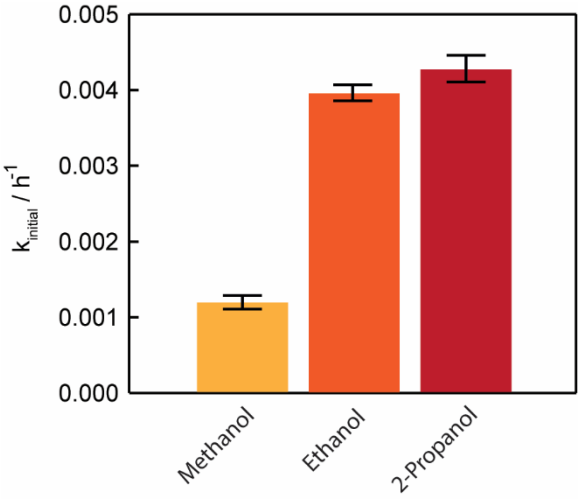


Figure S11. Initial reaction rate constants for 2-propanol, ethanol, and methanol photooxidation over a monolayer film of Medium $Ti_{0.87}O_2$ nanosheets.

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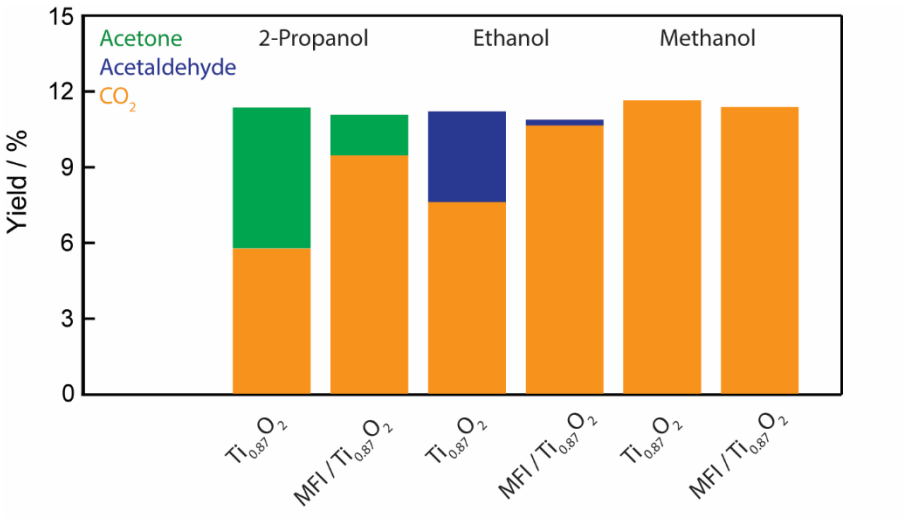


Figure S12. Yields of intermediates (acetone, acetaldehyde) and CO_2 at approximately 12% conversion of 2-propanol, ethanol, and methanol over a monolayer film of Medium $Ti_{0.87}O_2$ nanosheets and a bilayer film consisting of an MFI nanosheet monolayer deposited on top of a $Ti_{0.87}O_2$ nanosheet monolayer.

Table S1. Characteristics of the substrates used for the deposition of the $Ti_{0.87}O_2$ nanosheets.

Substrate	Bulk resistivity (Ω cm)	Ra (nm)
Quartz glass	10^{18}	0.56 ± 0.04
Si	10	0.08 ± 0.01
ITO (flat)	2×10^{-4}	0.69 ± 0.04
ITO (bumpy)	2×10^{-4}	4.46 ± 0.22

Table S2. Characteristics of the deposited films of Medium $Ti_{0.87}O_2$ nanosheets on various substrates estimated based on SEM and AFM measurements.

Substrate	Uncovered (%)	Monolayer (%)	Overlaps (%)	Ra (nm)
Quartz glass	27.8	50.5	21.7	1.07 ± 0.02
Si	8.1	83.8	8.1	0.48 ± 0.17
ITO (flat)	20.6	58.1	21.2	1.00 ± 0.08

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