catalysts

# Supplementary Materials: Tungsten-Based Mesoporous Silicates W-MMM-E as Heterogeneous Catalysts for Liquid-Phase Oxidations with Aqueous $H_2O_2$

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**Table S1.** Physicochemical properties of W–MMM–E catalysts after treatment with 0.11 M $H_2O_2$ or boiled water.

| Catalyst | Treatment | W,[a] ppm | $S_{BET}$, $m^2/g$ | $V_p$,[b] $cm^3/g$ | $D_p$,[c] nm |
|---|---|---|---|---|---|
| **A-1** | $H_2O_2$ [d] | 14 | n.d. | n.d. | n.d. |
| | $H_2O$ [e] | 43 | 930 | 0.40 | 2.35 |
| **A-2** | $H_2O_2$ [d] | 21 | n.d. | n.d. | n.d. |
| | $H_2O$ [e] | 107 | 1120 | 0.44 | 2.36 |
| **B-1** | $H_2O_2$ [d] | 5 | 920 | 0.38 | 2.54 |
| | $H_2O$ [e] | 39 | 910 | 0.40 | 2.54 |
| **B-1.4** | $H_2O_2$ [d] | 19 | 1170 | 0.52 | 2.62 |
| | $H_2O$ [e] | 19 | 890 | 0.39 | 2.53 |
| **C-1** | $H_2O_2$ [d] | 5 | 1170 | 0.46 | 2.35 |
| | $H_2O$ [e] | 30 | 980 | 0.38 | 2.32 |

[a] Amount of leached tungsten (in the reaction mixture after filtration of the catalyst) after catalys treatment with 0.11 M $H_2O_2$ and boiled water, respectively.

[b] Mesopore volume.

[c] Mean pore diameter.

[d] Catalyst treatment with aqueous $H_2O_2$ in $CH_3CN$ at 25 °C for 1 h.

[e] Catalyst treatment with boiled water for 6 h.

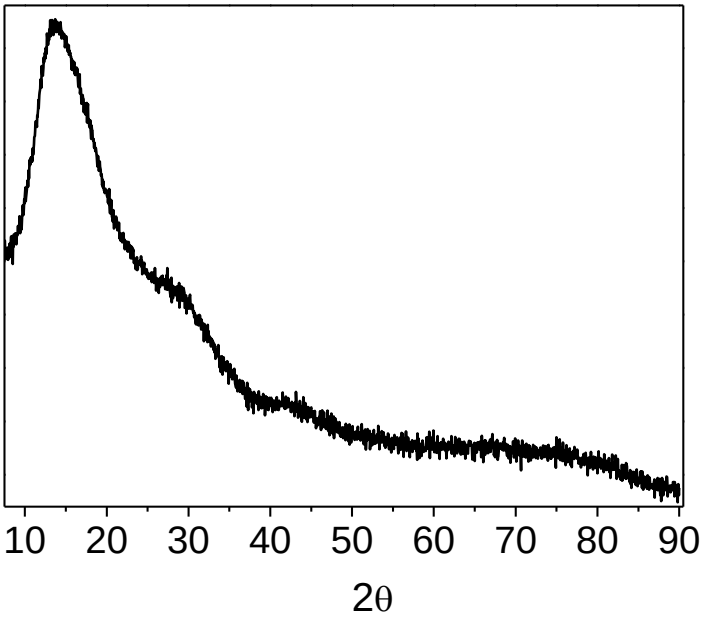



**Figure S1.** XRD pattern of calcined **A-1** catalyst.

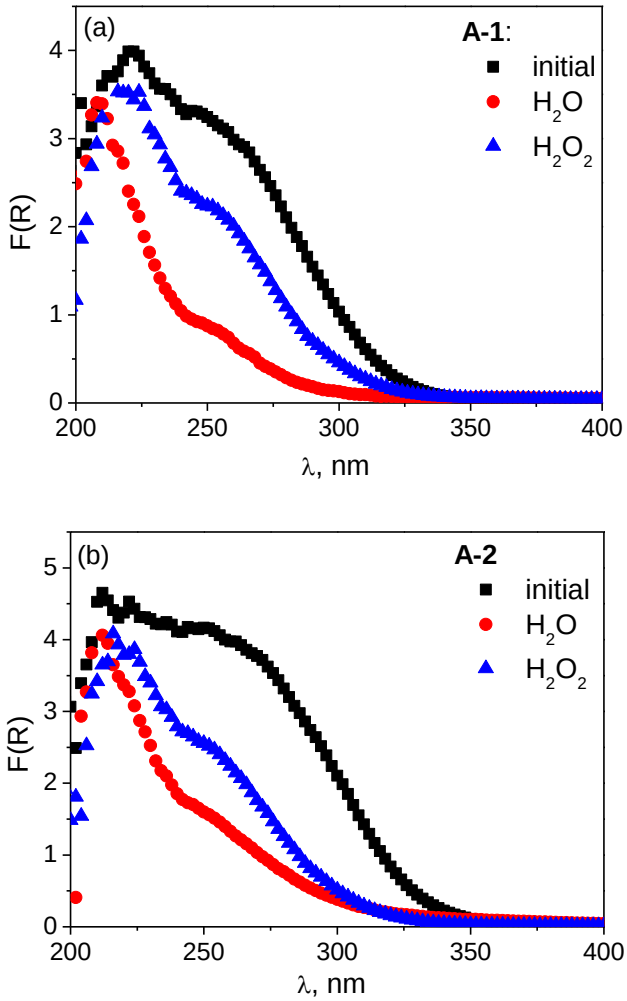


**Figure S2.** DR UV–vis spectra of calcined (a) **A-1** and (b) **A-2**: (■) initial, (●) after treatment with boiled water for 6 h, and (▲) after treatment with aqueous $H_2O_2$ in $CH_3CN$ (25 °C, 1 h).

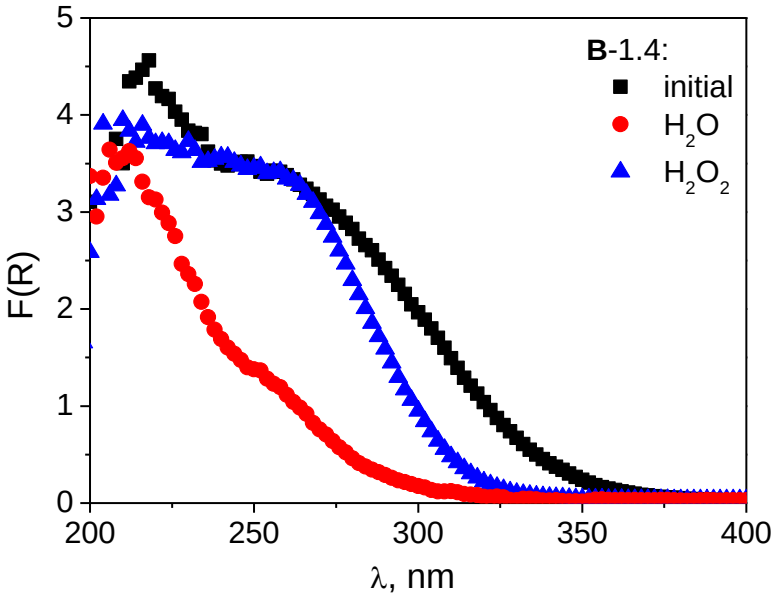
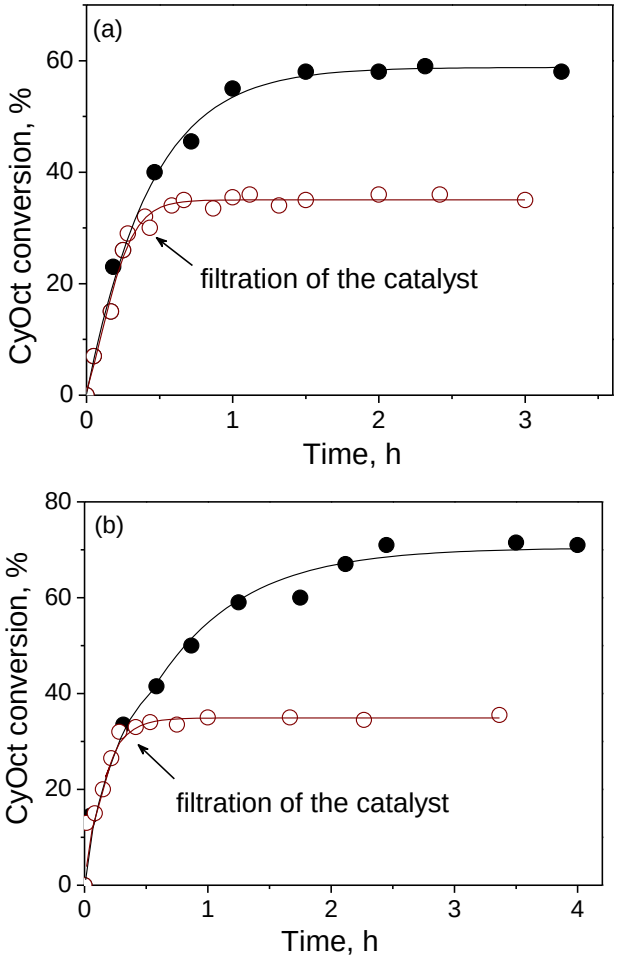



**Figure S3.** DR UV–vis spectra of calcined **B-1.4**: (■) initial, (●) after treatment with boiled water for 6 h, and (▲) after treatment with aqueous $H_2O_2$ in $CH_3CN$ (25 °C, 1 h).



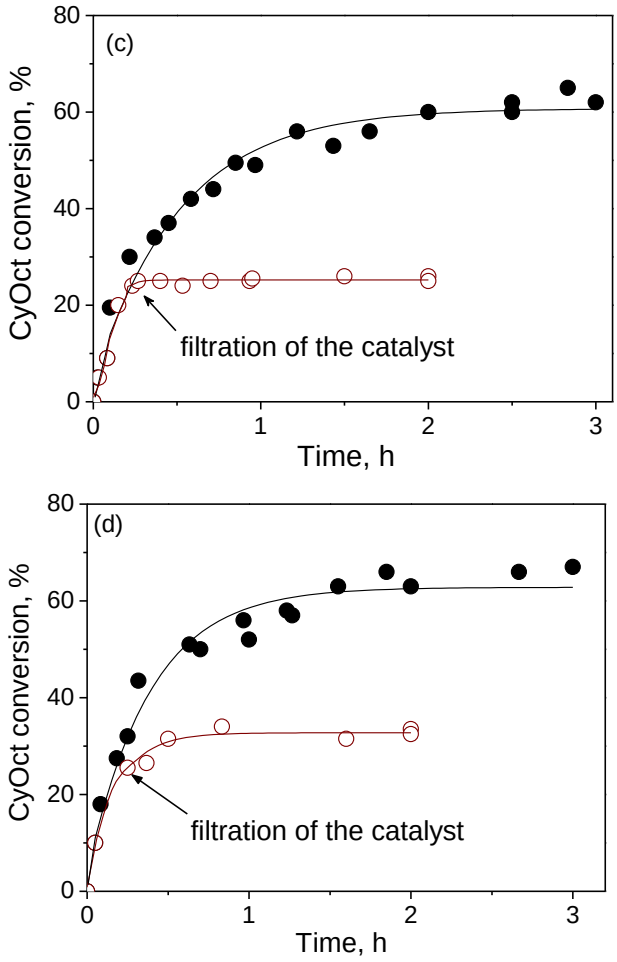
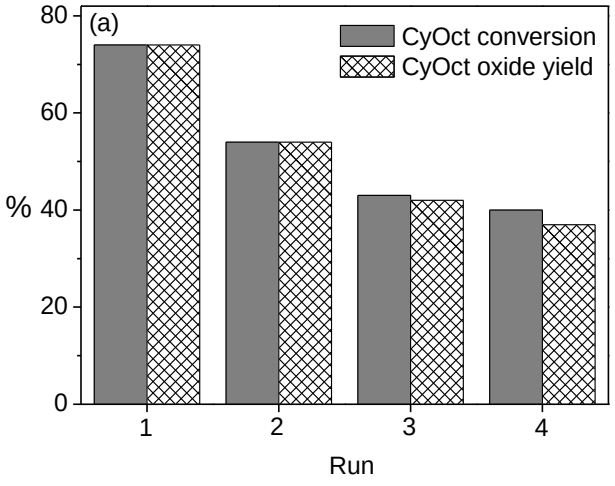



**Figure S4.** Hot catalyst filtration test for CyOct oxidation over (a) **A-2**, (b) **A-1**, (c) **B-1.4**, and (d) **B-1**. Reaction conditions: CyOct 0.1 mmol, $H_2O_2$ (30% aqueous solution) 0.1 mmol, catalyst 0.001 mmol of W; $CH_3CN$ 1 mL, 50 °C. (○) CyOct conversion after hot catalyst filtration.



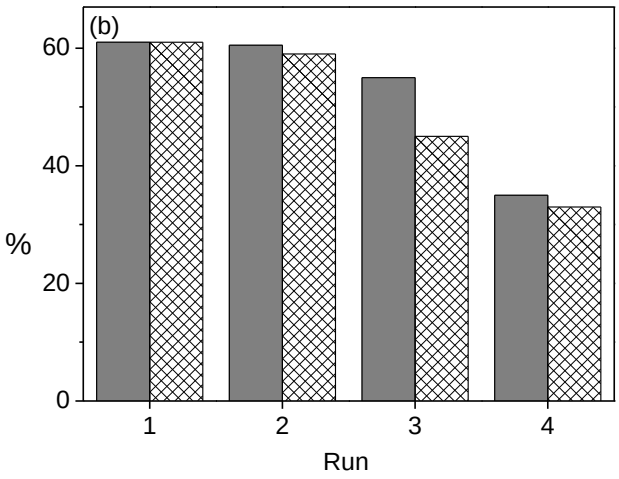



**Figure S5.** Reuse of **A-2** in CyOct oxidation with (a) 30% $H_2O_2$ and (b) 50% $H_2O_2$. Reaction conditions: CyOct 0.1 M, $H_2O_2$ 0.1 M, catalyst 30 mg, $CH_3CN$ 2 mL, 50 °C.

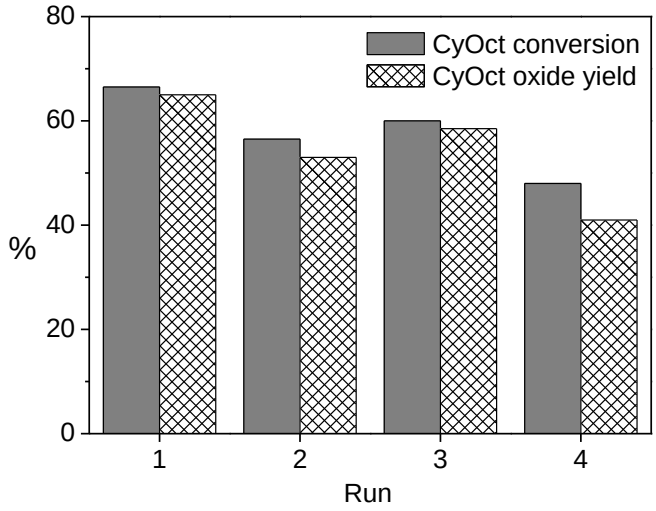



**Figure S6.** Reuse of **A-1** in CyOct oxidation with 30% $H_2O_2$. Reaction conditions: CyOct 0.1 M, $H_2O_2$ 0.1 M, catalyst 60 mg, $CH_3CN$ 2 mL, 50 °C.

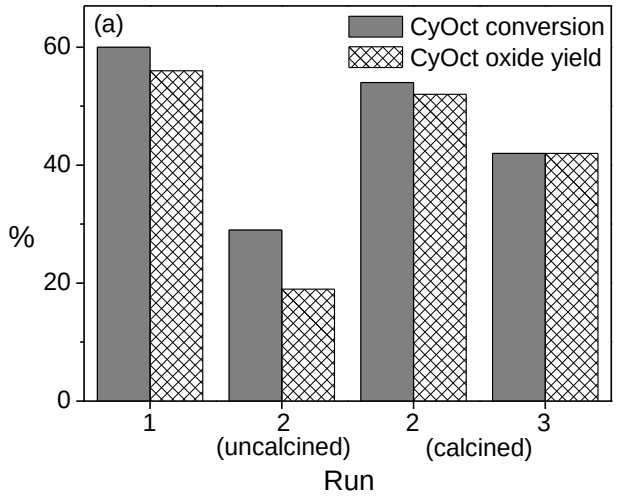



**Figure S7.** Reuse of **B-1.4** in CyOct oxidation with 50% $H_2O_2$. Reaction conditions: CyOct 0.1 M, $H_2O_2$ 0.1 M, catalyst 40 mg, $CH_3CN$ 2 mL, 50 °C.