Supplementary Information

Empowering visible-light-driven photocatalysis of Pd- and Pt-doped WO_3 nanoparticles: Role of oxygen vacancies and narrowed bandgap

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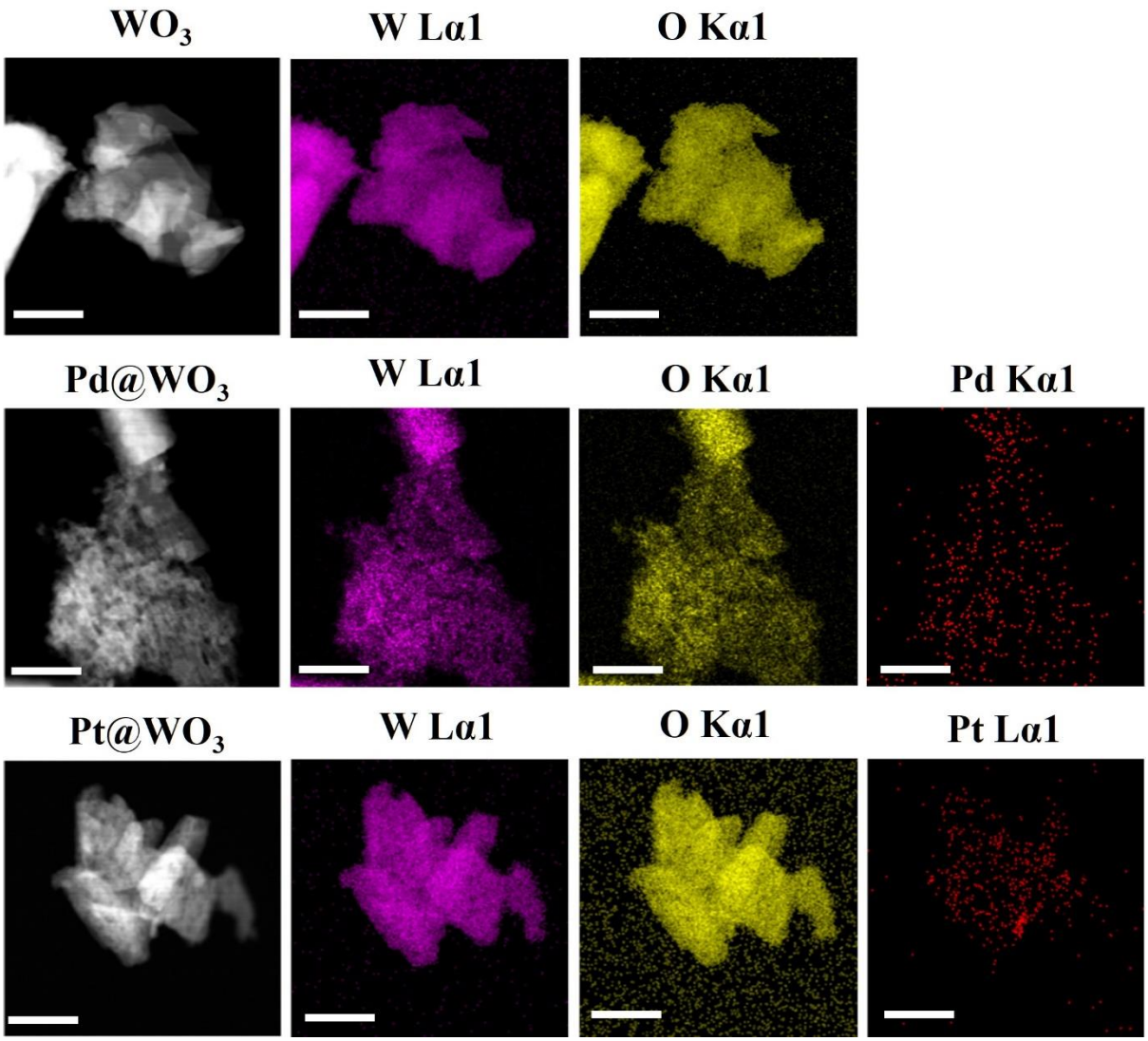

Figure S1. Energy-dispersive X-ray spectroscopy (EDS) of WO_3, Pd@WO_3, and Pt@WO_3 NPs. Scale bar is 100 nm

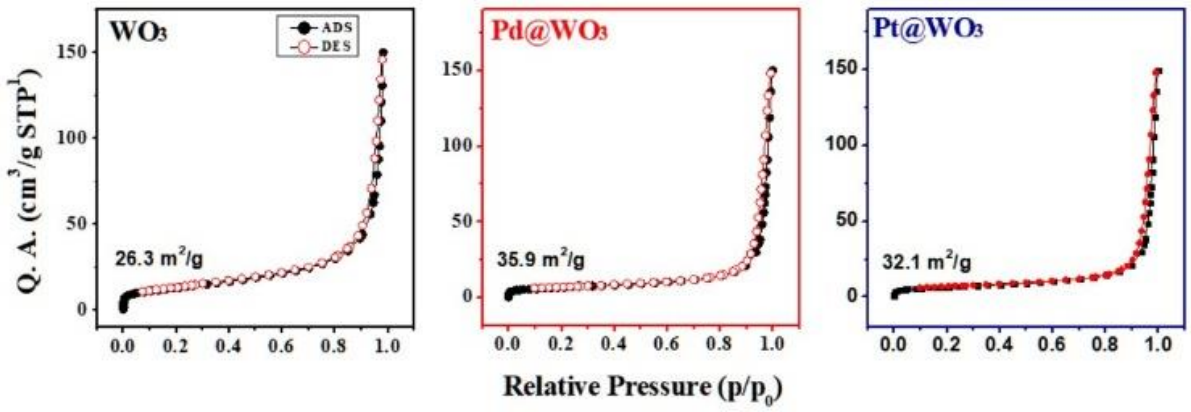

Figure S2. Brunauer–Emmett–Teller (BET) analysis of WO_3, Pd@WO_3, and Pt@WO_3 NPs.

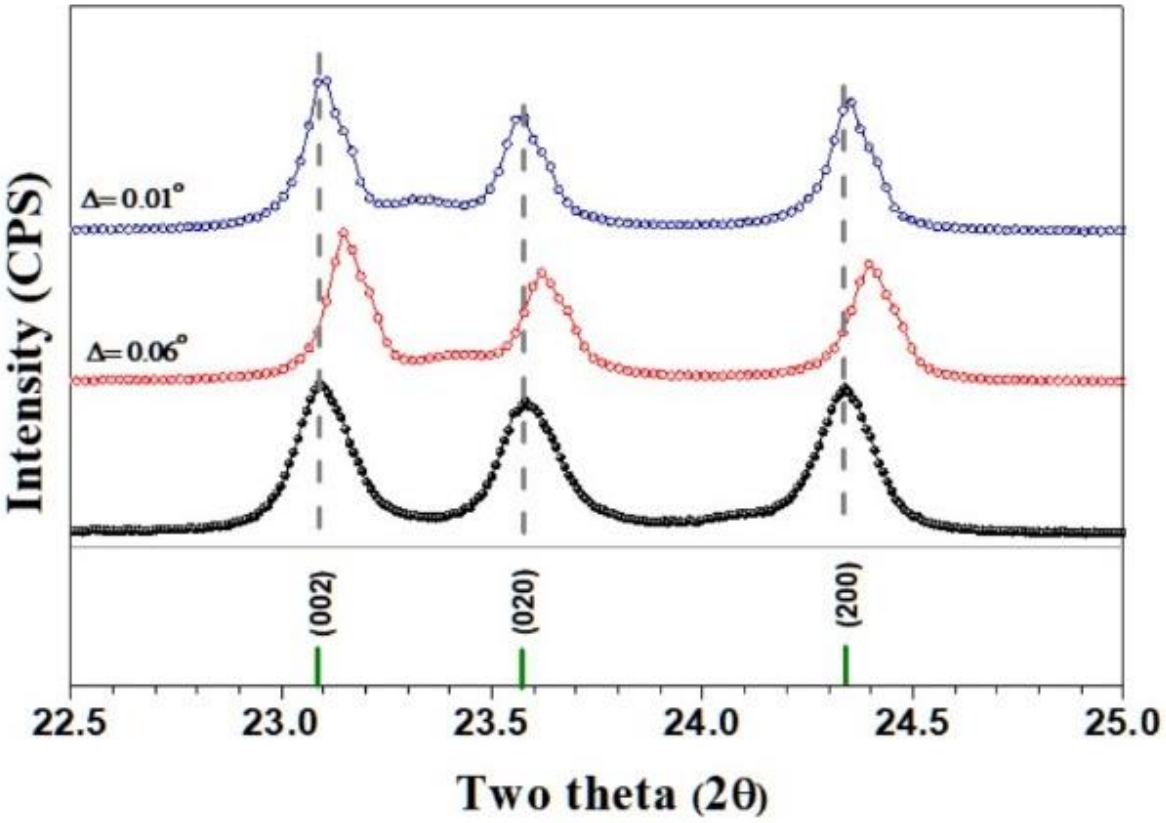

Figure S3. XRD patterns extended in 22.5~25.0^{o} of WO_3 (black dot), Pd@WO_3 (red dot), and Pt@WO_3 NPs (blue dot) NPs.

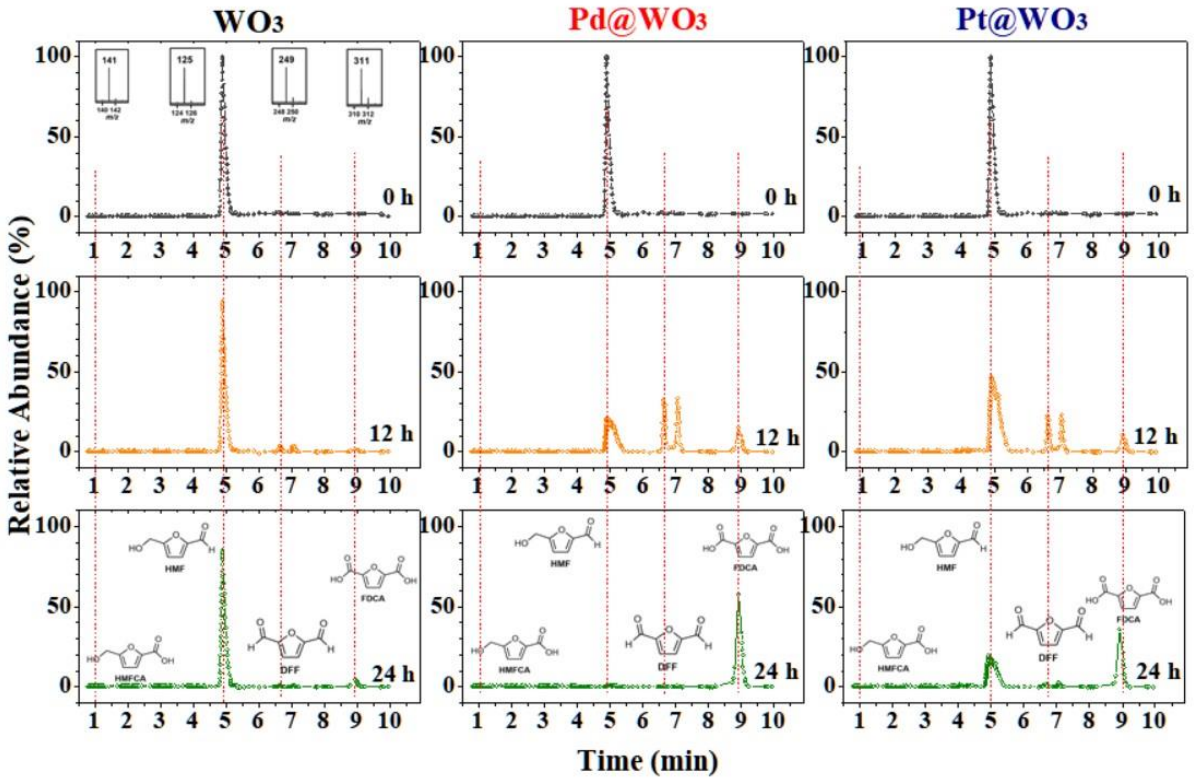

Figure S4. Liquid chromatography–mass spectrometry analysis of the selective oxidation of HMF on WO_3, Pd@WO_3, and Pt@WO_3 NPs.

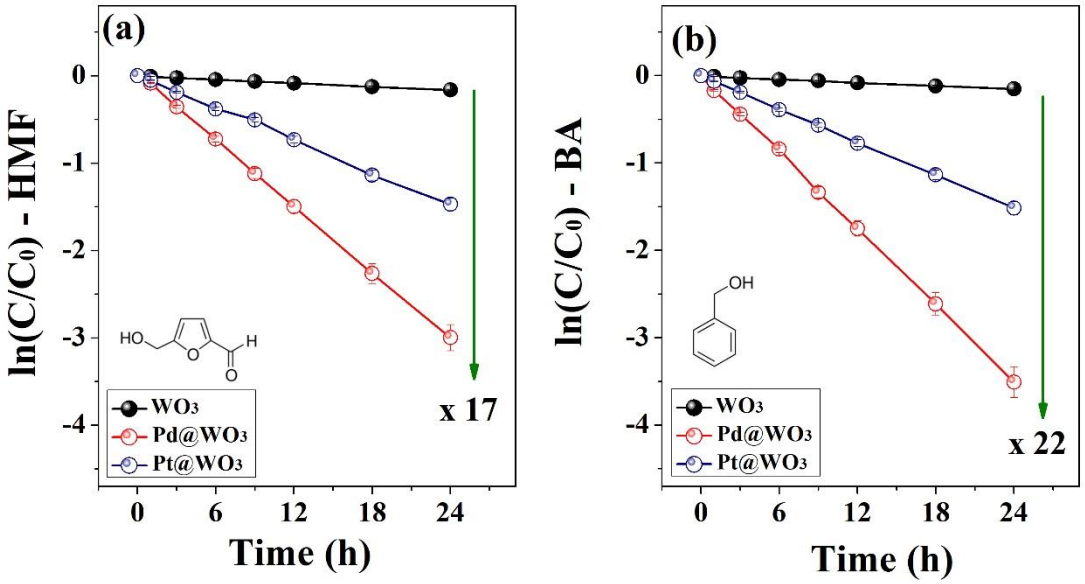

Figure S5. First-order rate constants (*k*) of the photocatalytic reaction of (a) HMF and (b) BA in the presence of WO_3 (black), Pd@WO_3 (red), and Pt@WO_3 NPs (navy blue).

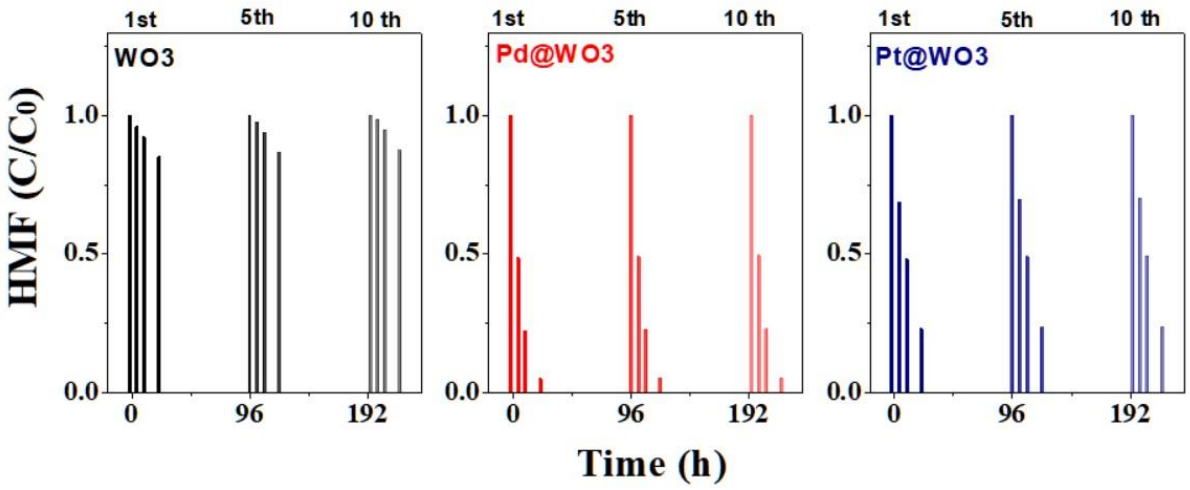

Figure S6. Cyclic photocatalytic HMF decomposition data acquired using WO_3, Pd@WO_3, and Pt@WO_3 NPs.

Table S1. M/W Ratio of Pd@WO_3 and Pt@WO_3 Nanoparticles Determined by XRF Analysis (M = Pd or Pt).

Sample	M/W ratio (weight %)	M/W ratio (mol%)
Pd@WO_3 NPs	3.1	5.3
Pt@WO_3 NPs	5.4	5.1

Table S2. Summary of the (002) peak positions of WO_3, full width at half maximum (FWHM), and crystallite sizes of WO_3, Pd@WO_3, and Pt@WO_3 NPs.

Sample	(002) peak position, 2θ	FWHM, 2θ	Size, nm
WO_3	23.09	0.14	60.49
Pd@WO_3	23.15	0.135	62.77
Pt@WO_3	23.10	0.134	63.23

Table S3. Photocatalytic reactivity of reported non-precious metal-doped WO_3 under λ_{ex} = 320 nm irradiation.[1]

catalyst	solvent	reaction conditions	4-CP conversion (%)
WO_3	H_2O	air, rt, 2 h	22
Cr@WO_3	H_2O	air, rt, 2 h	53
Mn@WO_3	H_2O	air, rt, 2 h	19
Fe@WO_3	H_2O	air, rt, 2 h	50
Ni@WO_3	H_2O	air, rt, 2 h	14
Co@WO_3	H_2O	air, rt, 2 h	7

Reference

1. H. Jeon, J. H. Park, S. Han, S. H. Ahn, J. Baik, H. Lee, H. S. Ahn, S. Hong, *Appl*. *Surf*. *Sci*. 2021, **567**, 150834.