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## Supplementary on-line information

# Continuous flow synthesis of bimetallic AuPd catalysts for the selective oxidation of 5-hydroxymethylfurfural to 2,4-furandicarboxylic acid

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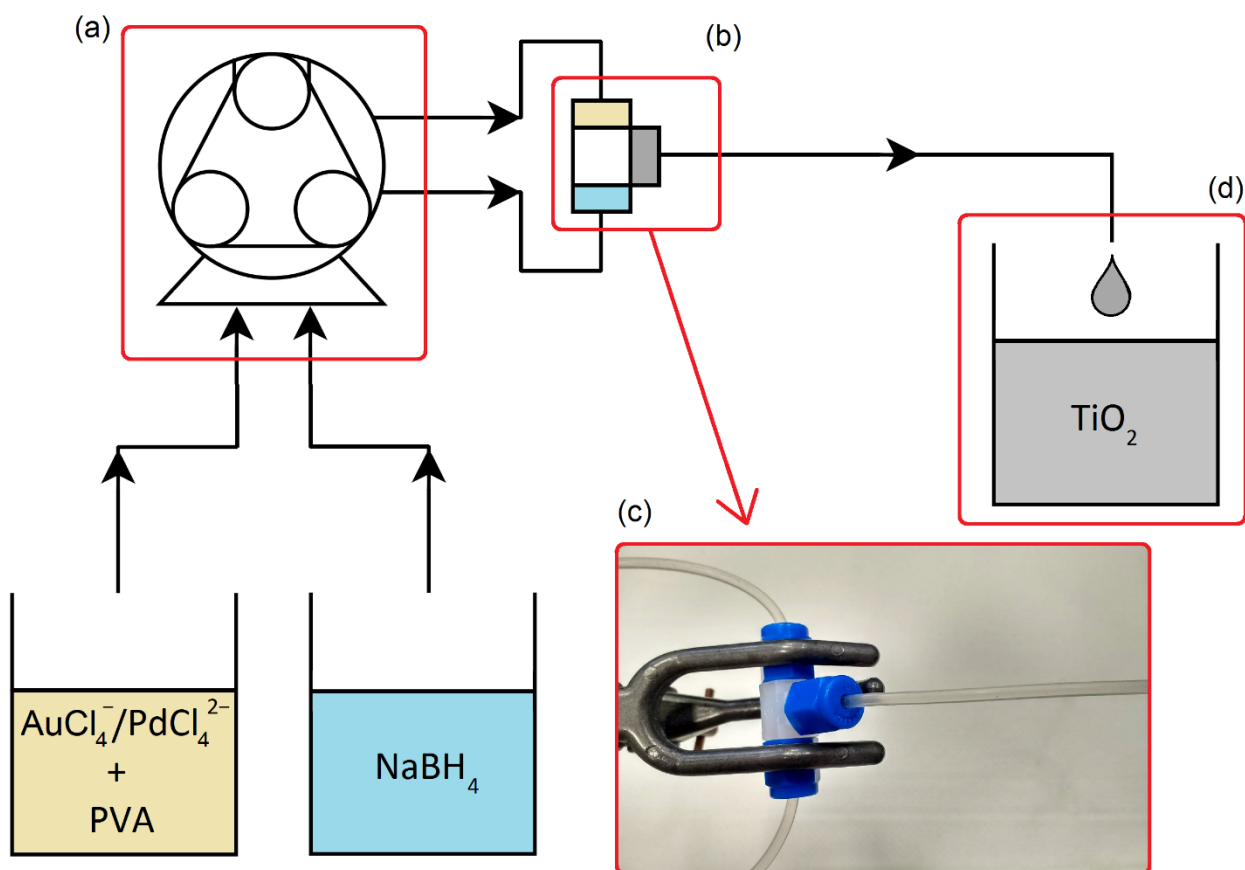
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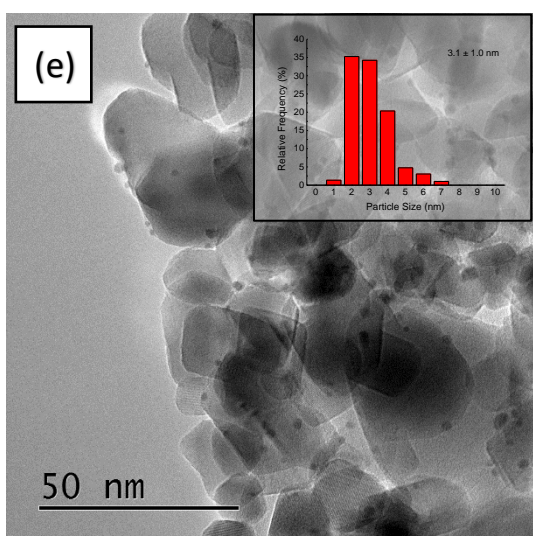
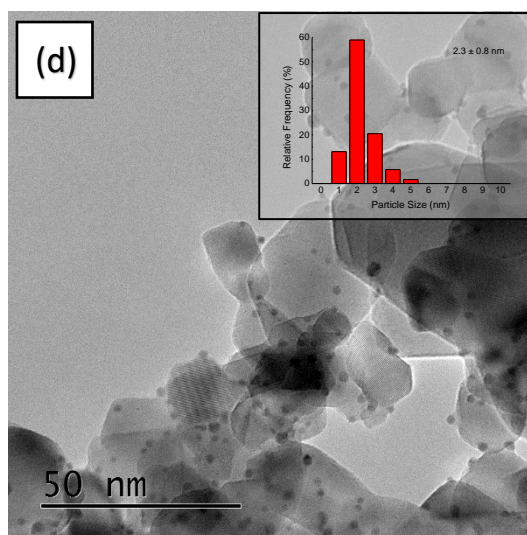
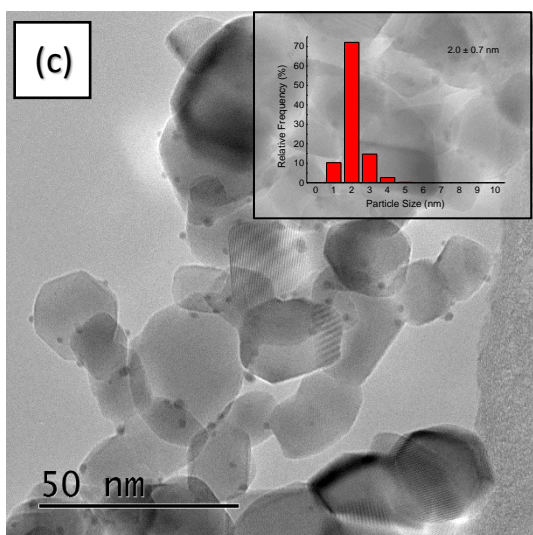
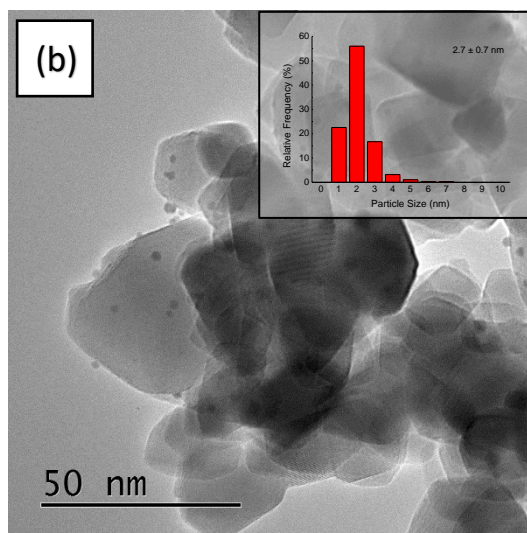
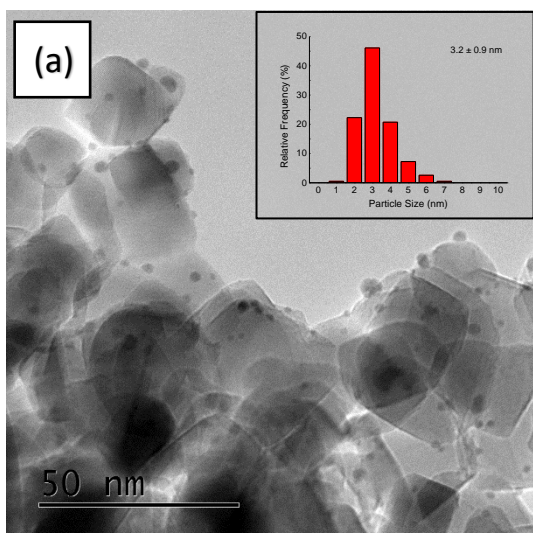
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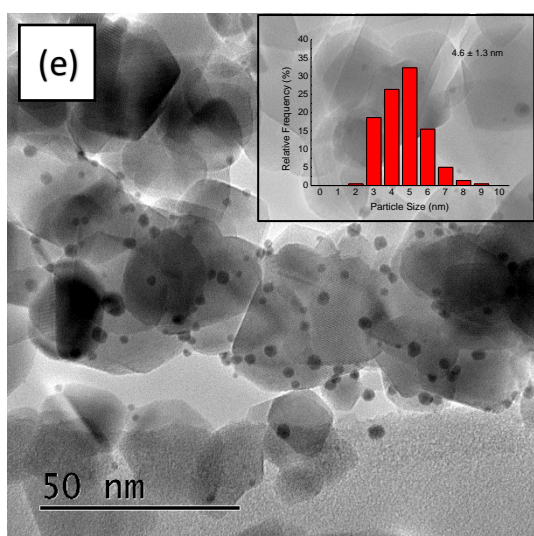
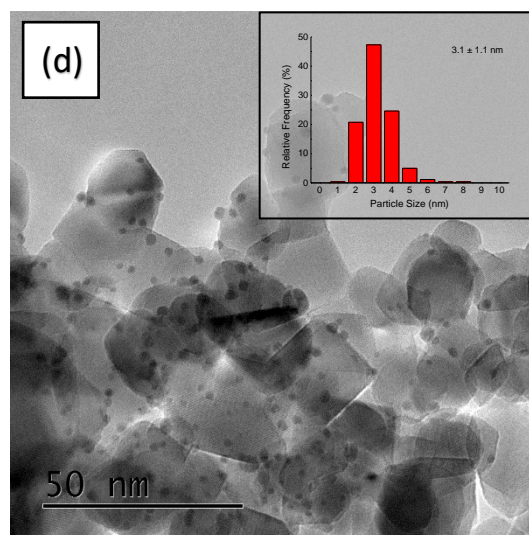
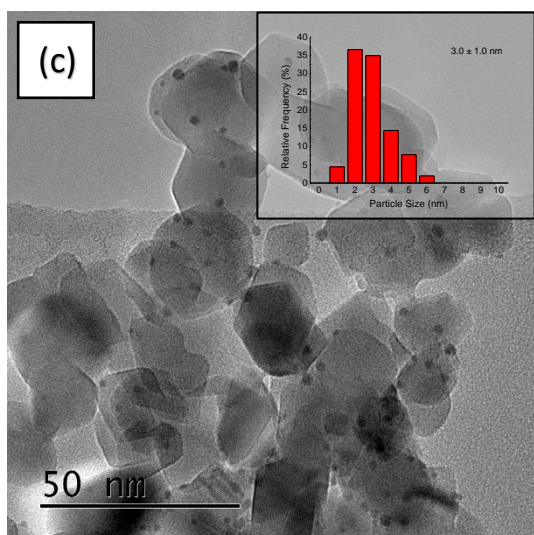
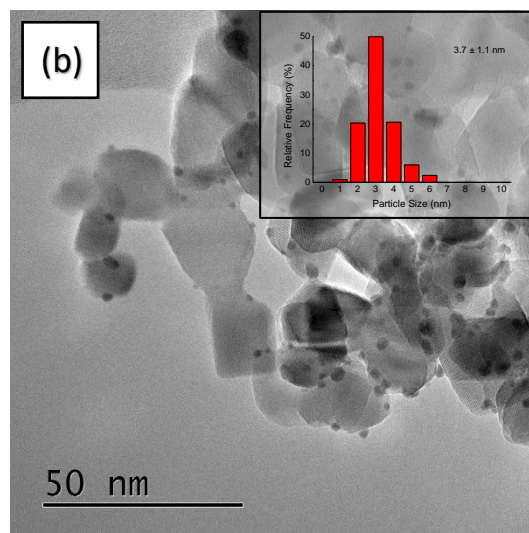
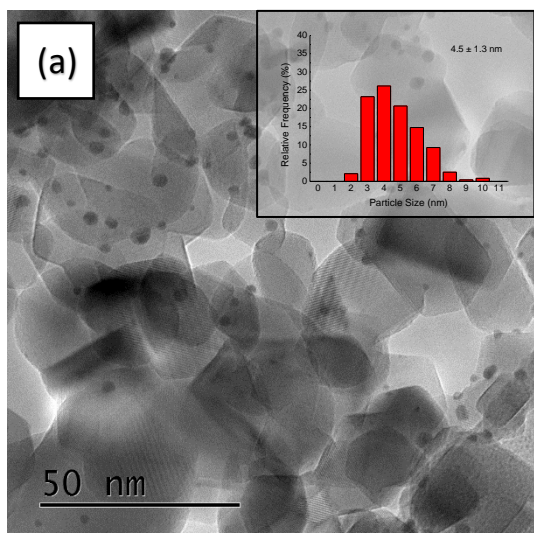


*Figure S1: Schematic representation of the millifluidic set-up for the synthesis of  $Au_xPd_y/TiO_2$  catalysts in continuous mode. (a) Peristaltic pump, (b) PFA T-shape connection, (c) image of the PFA T-shape connection and (d) suspension of  $TiO_2$  in water.*

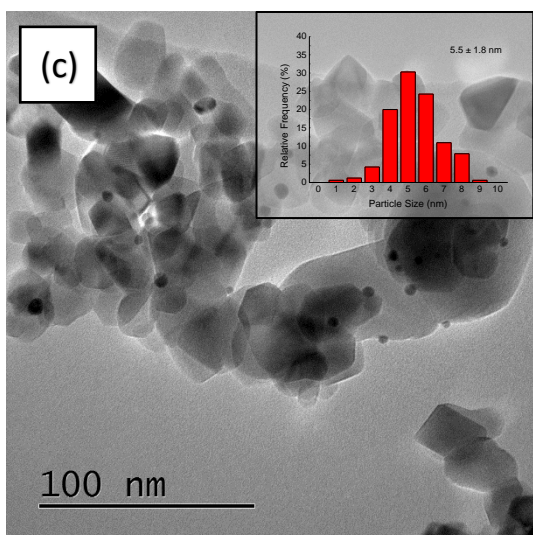
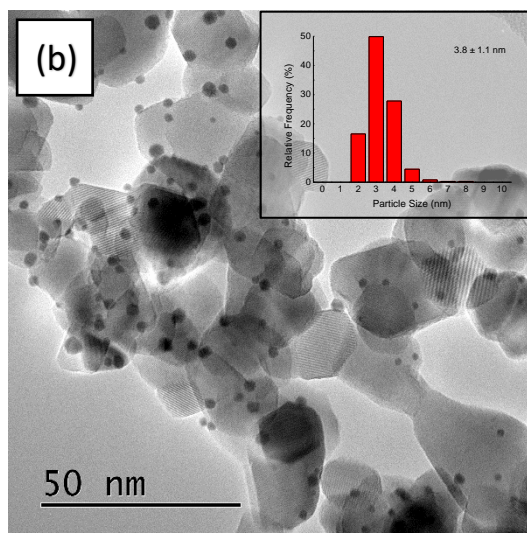
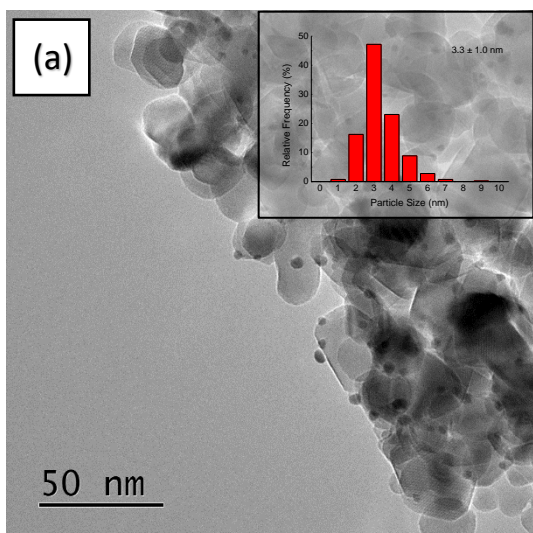


**Figure S2:** Representative BF-TEM images and (inset) respective particle size distributions of the various catalysts prepared in continuous mode: (a) Au/TiO<sub>2</sub>, (b) Au<sub>75</sub>Pd<sub>25</sub>/TiO<sub>2</sub>, (c) Au<sub>50</sub>Pd<sub>50</sub>/TiO<sub>2</sub>, (d) Au<sub>25</sub>Pd<sub>75</sub>/TiO<sub>2</sub> and (e) Pd/TiO<sub>2</sub>.

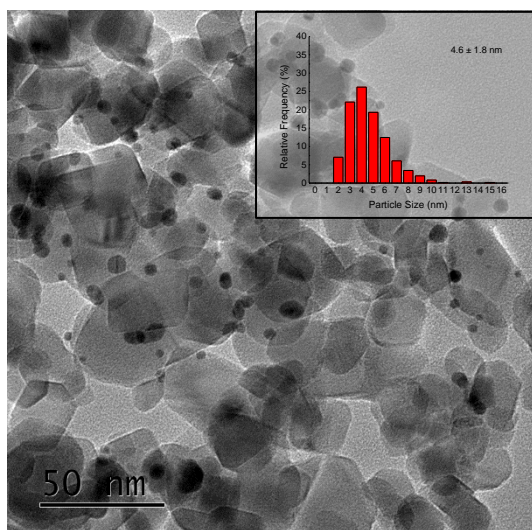




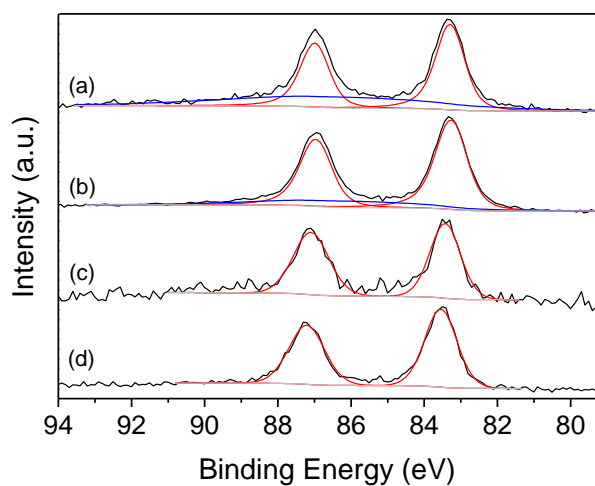
**Figure S3:** Representative BF-TEM images and (inset) the respective particle size distribution of the various catalysts prepared in batch mode: (a) Au/TiO<sub>2</sub>, (b) Au<sub>75</sub>Pd<sub>25</sub>/TiO<sub>2</sub>, (c) Au<sub>50</sub>Pd<sub>50</sub>/TiO<sub>2</sub>, (d) Au<sub>25</sub>Pd<sub>75</sub>/TiO<sub>2</sub> and (e) Pd/TiO<sub>2</sub>.



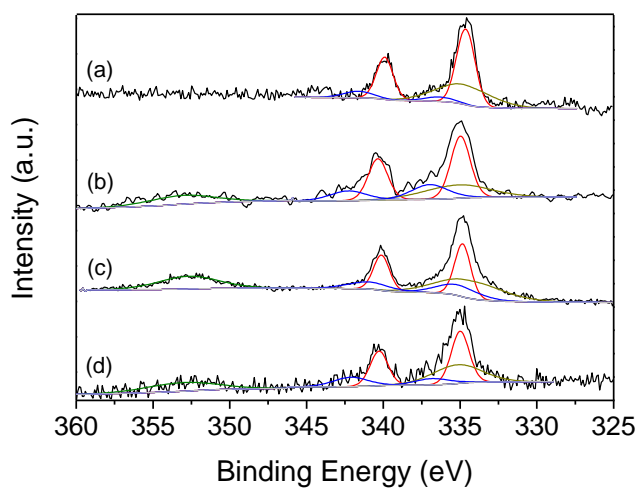
*Figure S4: Representative BF-TEM images and (inset) the respective particle size distributions of the  $Au_{75}Pd_{25}/TiO_2$  catalyst prepared in continuous mode and subjected to thermal calcination treatment at (a) 200 °C, (b) 300 °C and (c) 400 °C.*



*Figure S5: Representative BF-TEM image of the  $Au_{75}Pd_{25}/TiO_2$  catalyst prepared in continuous mode and heat treated at 200 °C after the 5<sup>th</sup> catalysis run. The particle size distribution is shown in the inset.*

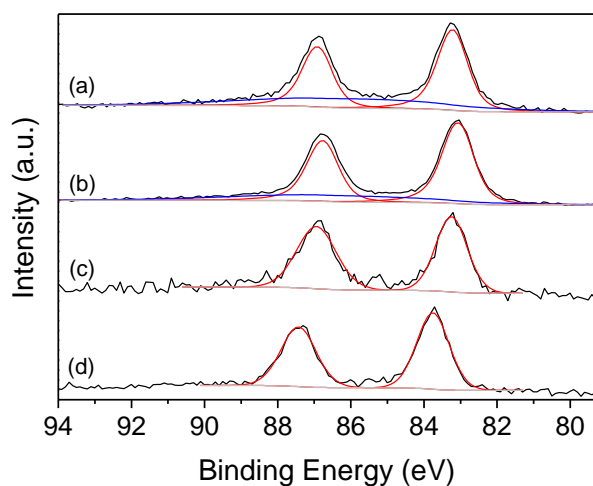


**Figure S6:** Au4f XPS analysis of the batch-prepared catalysts. (a)  $\text{Au}_{25}\text{Pd}_{75}/\text{TiO}_2$ , (b)  $\text{Au}_{50}\text{Pd}_{50}/\text{TiO}_2$ , (c)  $\text{Au}_{75}\text{Pd}_{25}/\text{TiO}_2$  and (d)  $\text{Au}/\text{TiO}_2$ . The red fitting represents the  $\text{Au}^0$ , while the blue fitting represents the satellite Pd 4s peak.

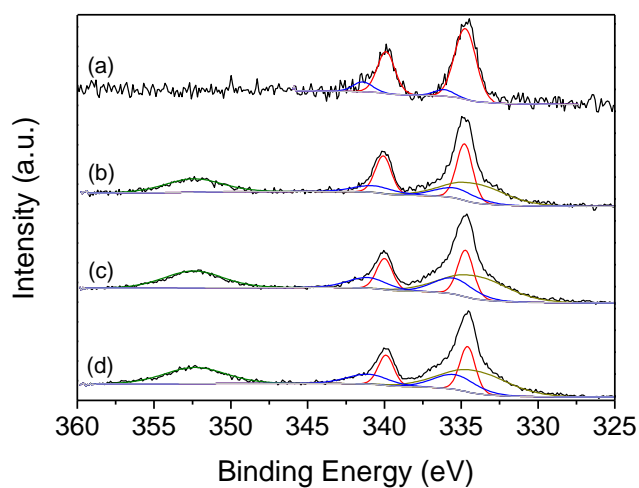


**Figure S7:** Pd3d XPS analysis of the batch-prepared catalysts. (a)  $\text{Pd}/\text{TiO}_2$ , (b)  $\text{Au}_{25}\text{Pd}_{75}/\text{TiO}_2$ , (c)  $\text{Au}_{50}\text{Pd}_{50}/\text{TiO}_2$  and (d)  $\text{Au}_{75}\text{Pd}_{25}/\text{TiO}_2$ . The red fitting represents the  $\text{Pd}^0$ , while the blue fitting represents the  $\text{Pd}^{2+}$ ; the green fitting represents the satellite Au 4d peaks.

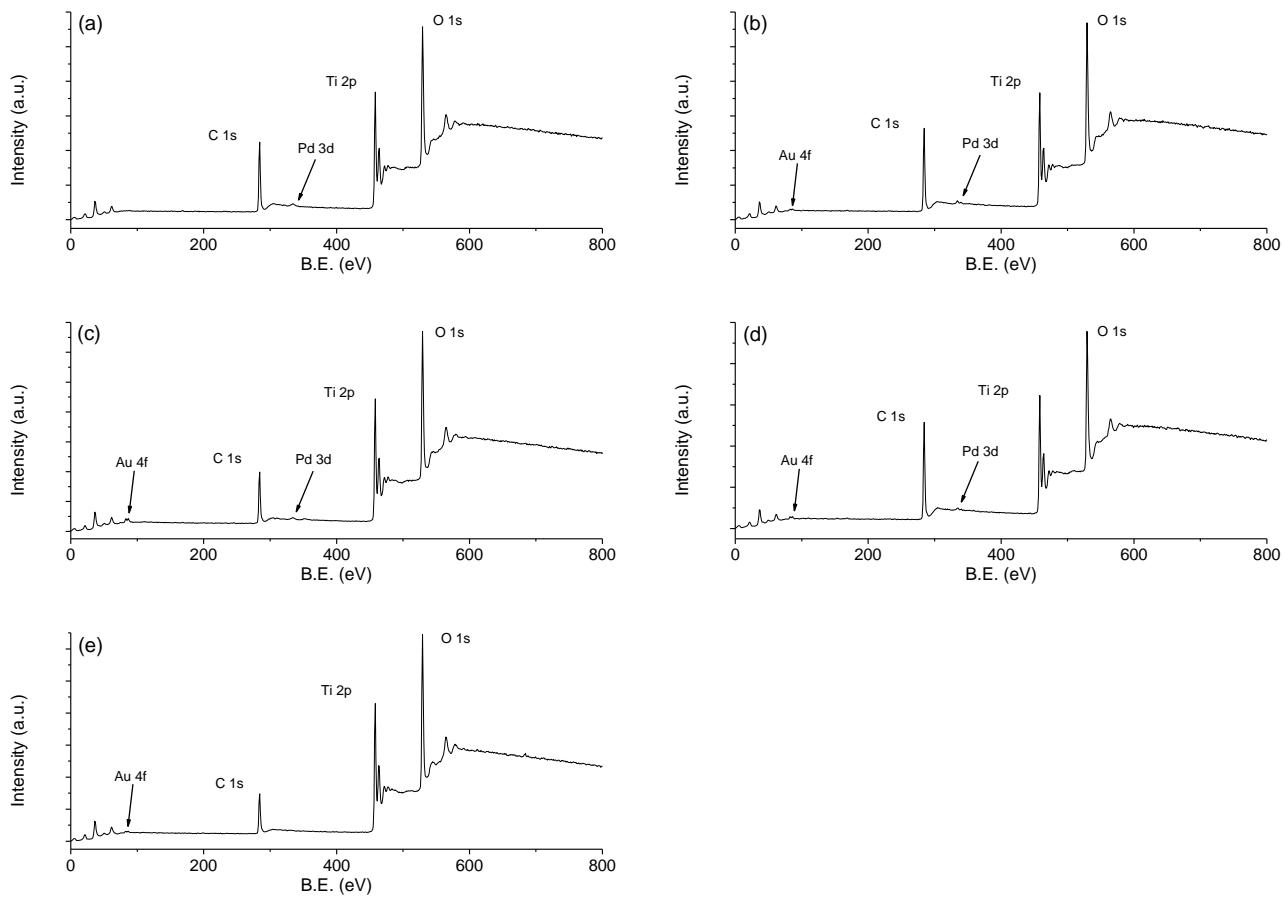




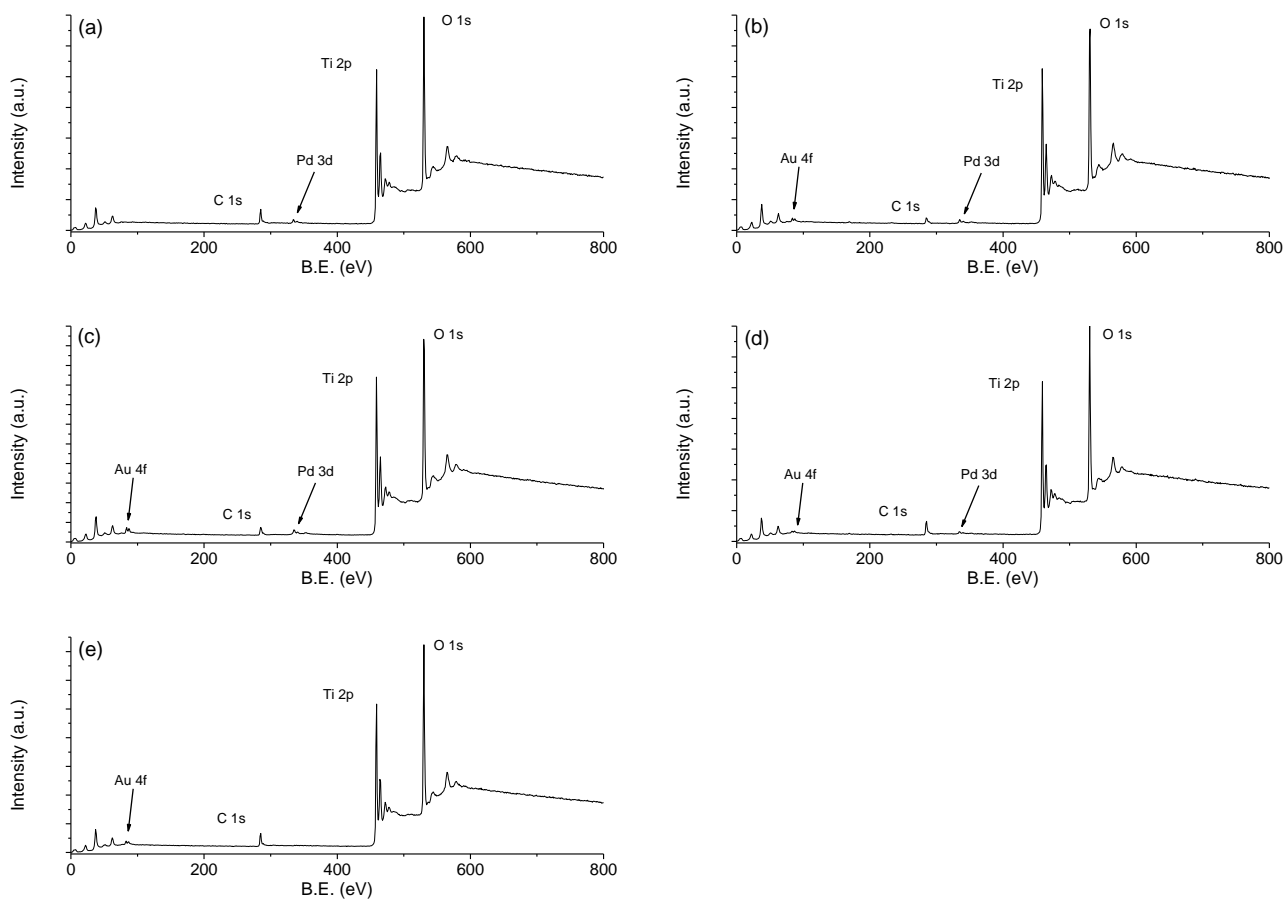
**Figure S8:** Au4f XPS analysis of the continuous-prepared catalysts. (a)  $Au_{25}Pd_{75}/TiO_2$ , (b)  $Au_{50}Pd_{50}/TiO_2$ , (c)  $Au_{75}Pd_{25}/TiO_2$  and (d)  $Au/TiO_2$ . The red fitting represents the  $Au^0$ , while the blue fitting represents the satellite Pd 4s peak.



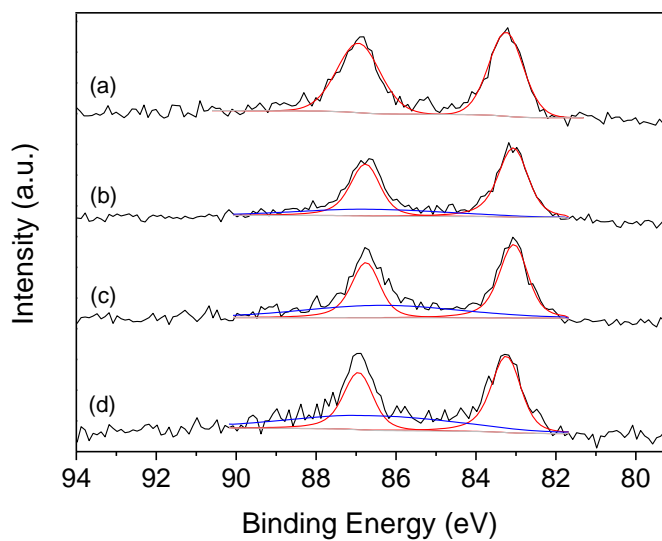
**Figure S9:** Pd3d XPS analysis of the continuous-prepared catalysts. (a)  $Pd/TiO_2$ , (b)  $Au_{25}Pd_{75}/TiO_2$ , (c)  $Au_{50}Pd_{50}/TiO_2$  and (d)  $Au_{75}Pd_{25}/TiO_2$ . The red fitting represents the  $Pd^0$ , while the blue fitting represents the  $Pd^{2+}$ ; the green fitting represents the satellite Au 4d peaks.



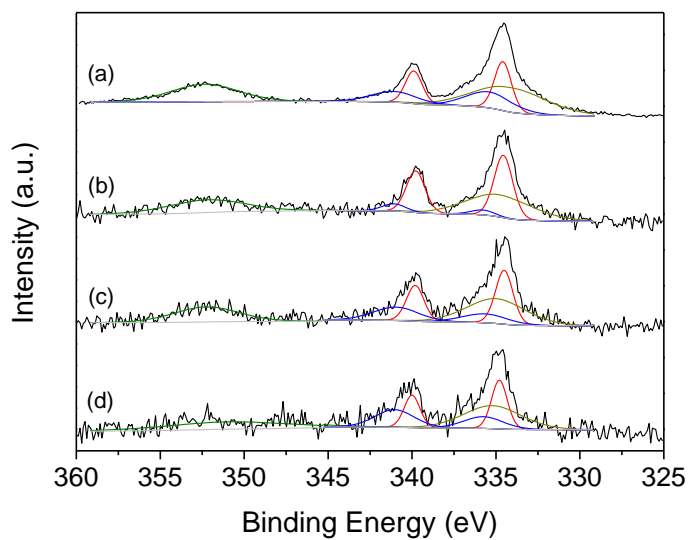
**Figure S10:** XPS survey scans for the batch-prepared catalysts. (a) Pd/TiO<sub>2</sub>, (b) Au<sub>25</sub>Pd<sub>75</sub>/TiO<sub>2</sub>, (c) Au<sub>50</sub>Pd<sub>50</sub>/TiO<sub>2</sub>, (d) Au<sub>75</sub>Pd<sub>25</sub>/TiO<sub>2</sub> and (e) Au/TiO<sub>2</sub>.



**Figure S11:** XPS survey scans for the continuous-prepared catalysts. (a) Pd/TiO<sub>2</sub>, (b) Au<sub>25</sub>Pd<sub>75</sub>/TiO<sub>2</sub>, (c) Au<sub>50</sub>Pd<sub>50</sub>/TiO<sub>2</sub>, (d) Au<sub>75</sub>Pd<sub>25</sub>/TiO<sub>2</sub> and (e) Au/TiO<sub>2</sub>.

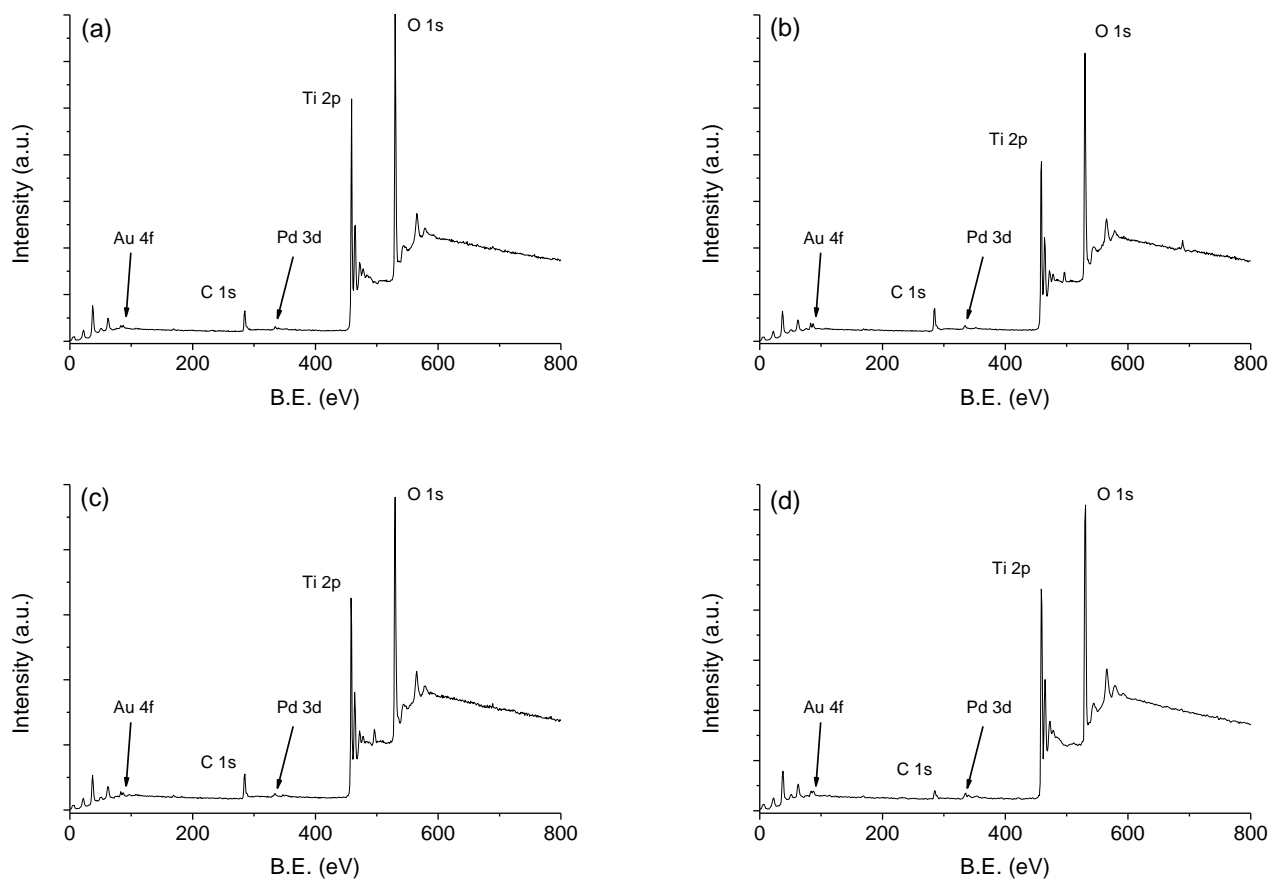


**Figure S12:** Au4f XPS analysis of the continuous-prepared Au<sub>75</sub>Pd<sub>25</sub>/TiO<sub>2</sub> catalysts heat treated at different temperature. (a) untreated, (b) 200 °C, (c) 300 °C and (d) 400 °C. The red fitting represents the Au<sup>0</sup>, while the blue fitting represents the satellite Pd 4s peak.



**Figure S13:** Pd3d XPS analysis of the continuous-prepared Au<sub>75</sub>Pd<sub>25</sub>/TiO<sub>2</sub> catalysts heat treated at different temperature. (a) untreated, (b) 200 °C, (c) 300 °C and (d) 400 °C. The red fitting represents the Pd<sup>0</sup>, while the blue fitting represents the Pd<sup>2+</sup>; the green fitting represents the satellite Au 4d peaks.





**Figure S14:** XPS survey scans for the continuous-prepared  $\text{Au}_{75}\text{Pd}_{25}/\text{TiO}_2$  catalysts heat treated at different temperature. (a) untreated, (b) 200 °C, (c) 300 °C and (d) 400 °C.

*Table S1: Au:Pd molar ratio and Au 4f<sub>7/2</sub> and Pd 3d<sub>5/2</sub> binding energy of the catalysts prepared in in continuous (Au<sub>75</sub>Pd<sub>25</sub>/TiO<sub>2</sub>-C) heat treated at different temperature. The ratios are calculated from XPS quantification.*

Catalyst	Au:Pd ratio (mol/mol)	Binding Energy (eV)	
		Au 4f <sub>7/2</sub>	Pd 3d <sub>5/2</sub>
Au <sub>75</sub> Pd <sub>25</sub> /TiO <sub>2</sub> -C	76 : 24	83.2	334.7
Au <sub>75</sub> Pd <sub>25</sub> /TiO <sub>2</sub> -C-200	72 : 28	83.1	334.7
Au <sub>75</sub> Pd <sub>25</sub> /TiO <sub>2</sub> -C-300	70 : 30	83.1	334.6
Au <sub>75</sub> Pd <sub>25</sub> /TiO <sub>2</sub> -C-400	71 : 29	83.2	334.8