Electronic Supplementary Material (ESI) for Catalysis Science & Technology

Electronic Supplementary Information

Propylene epoxidation with O_2 and H_2: A high-performance Au/TS-1 catalyst prepared via deposition-precipitation using urea

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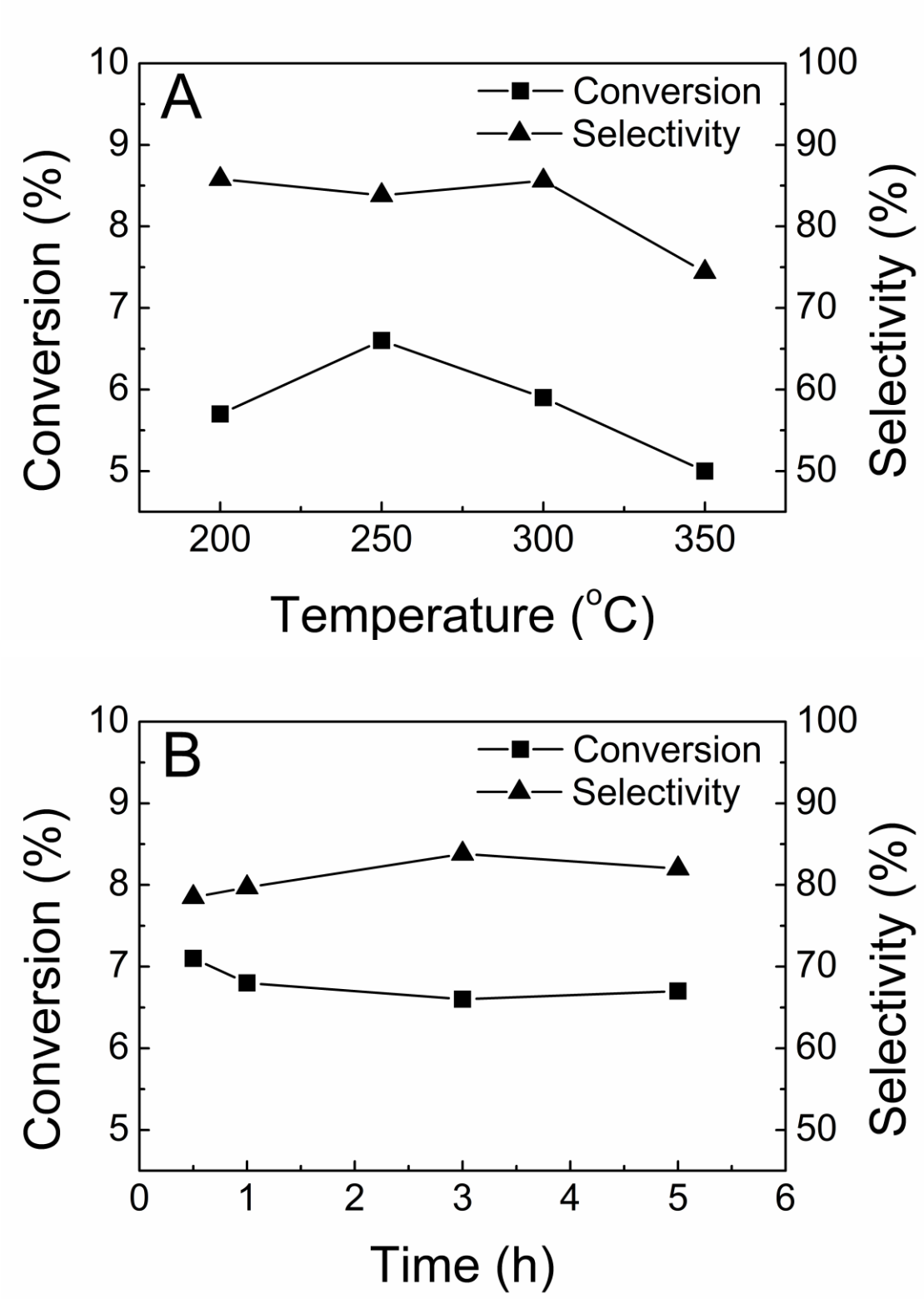

Figure S1. The influences of pre-reduction temperature (A; constant time of 3 h) and time (B; constant temperature of 250 ^{o}C) in H_2 on the performance of Au-1/TS-1-*syn* for the epoxidation of propylene. Reaction testing conditions: catalyst loading of 0.3 g, 150 ^{o}C, C_3H_6: O_2: H_2: N_2 = 1: 2: 3: 14, GHSV = 6600 ml h^{-1} g^{-1}.

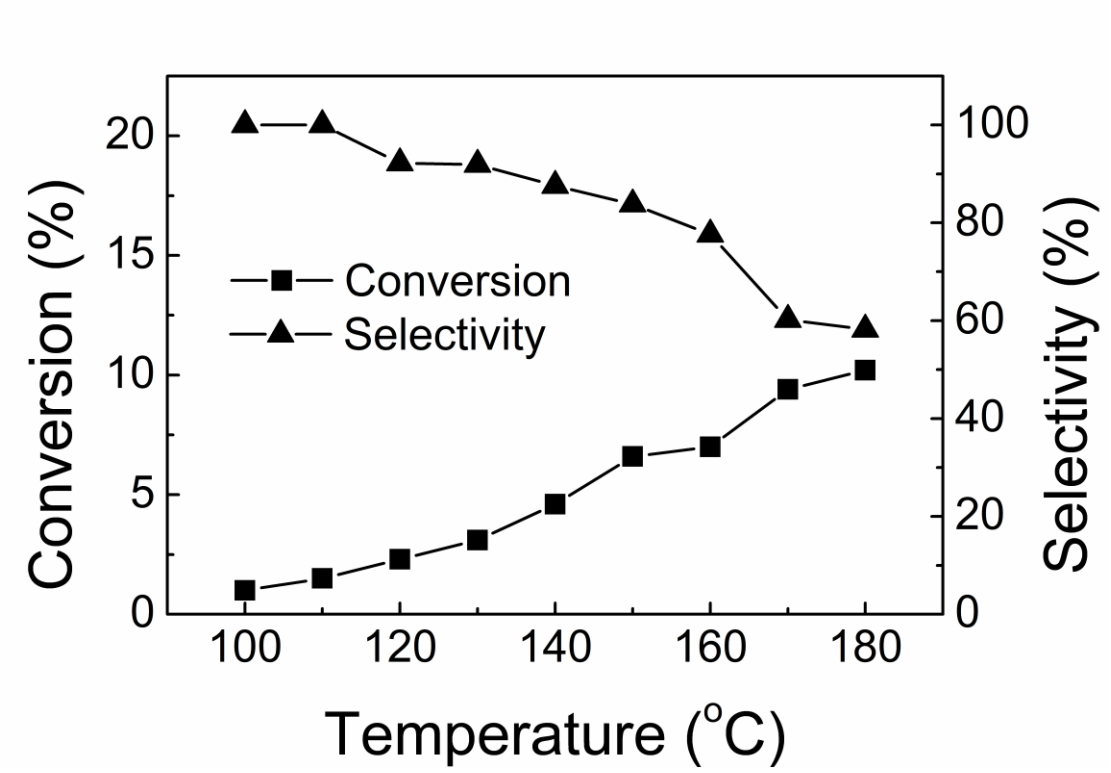

Figure S2. The influence of reaction temperature on the performance of Au-1/TS-1-*syn* for the epoxidation of propylene. Reaction testing conditions: catalyst loading of 0.3 g, C_3H_6: O_2: H_2: N_2 = 1: 2: 3: 14, GHSV = 6600 ml h^{-1} g^{-1}. The catalysts were pre-reduced in H_2 at 250 ^oC for 1 h before the test.

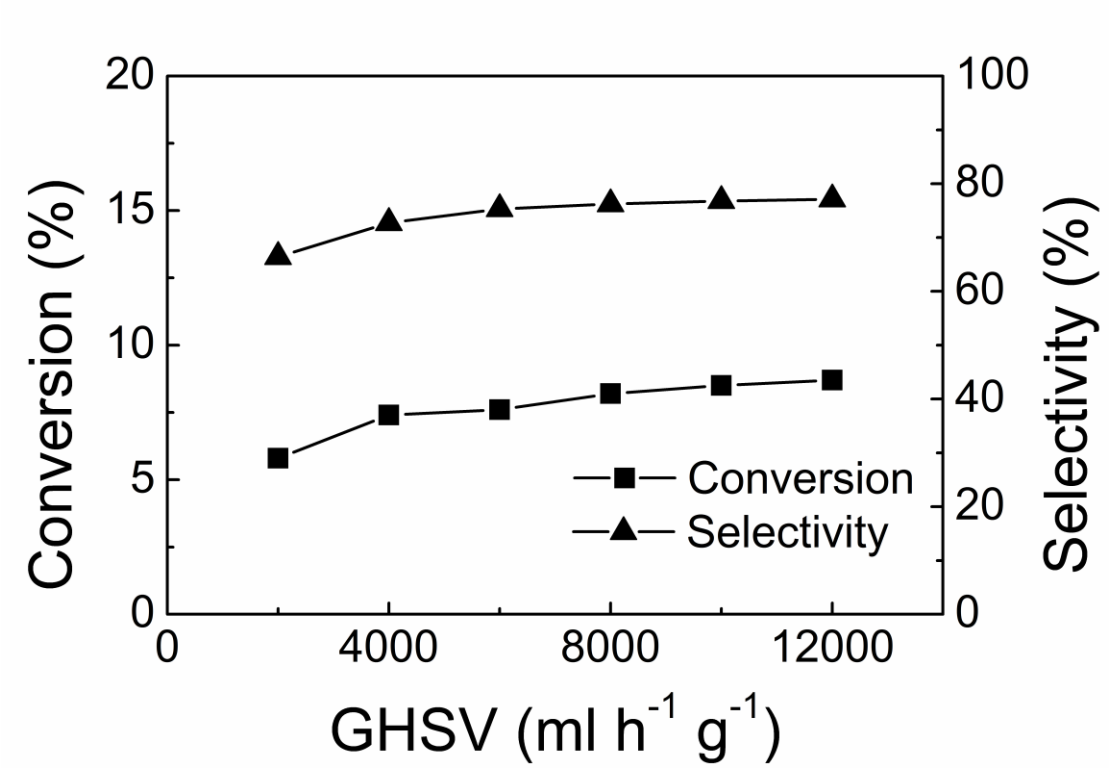

Figure S3. The influence of gas hourly space velocity (GHSV/ml h^{-1} g^{-1}) on the performance of Au-1/TS-1-*syn* for the epoxidation of propylene. The catalysts were pre-reduced in H_2 at 250 ^oC for 1 h before the test. Reaction testing conditions: catalyst loading of 0.3 g, 150 ^oC, C_3H_6: O_2: H_2: N_2 = 1: 3: 9: 12.

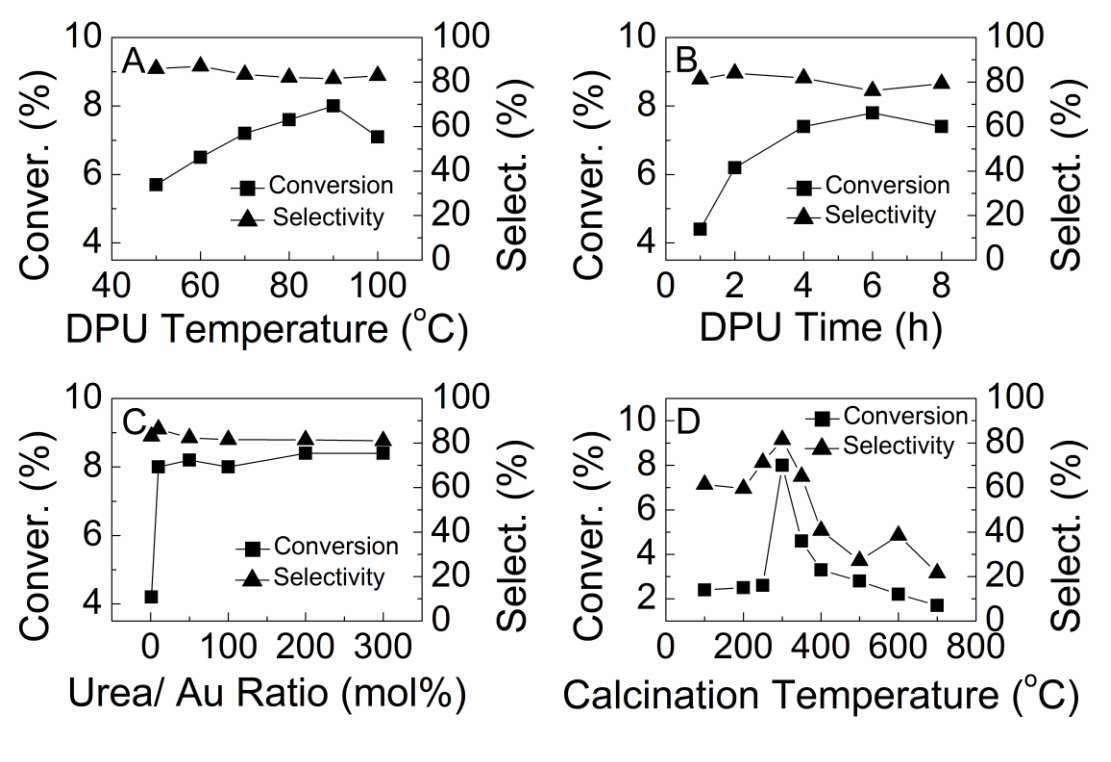

Figure S4. The influences of DPU temperature (A), time (B), urea/Au molar ratio (C) and catalyst calcination temperature (D) on the performance of Au/TS-1-*syn* for the epoxidation of propylene. The default catalyst preparation conditions were light free, DPU temperature 90 ^{o}C, DPU time 4.5 h, urea/Au molar ratio of 100 and a calcination temperature of 300 ^{o}C in air, unless investigated in detail otherwise. The gold loading of all the catalysts was 1 wt% and all the catalysts were pre-reduced in H_2 at 250 ^{o}C for 1 h before test. Reaction testing conditions: catalyst loading of 0.3 g, 150 ^{o}C, C_3H_6: O_2: H_2: N_2 = 1: 3: 9: 12, GHSV = 12000 ml h^{-1} g^{-1}.

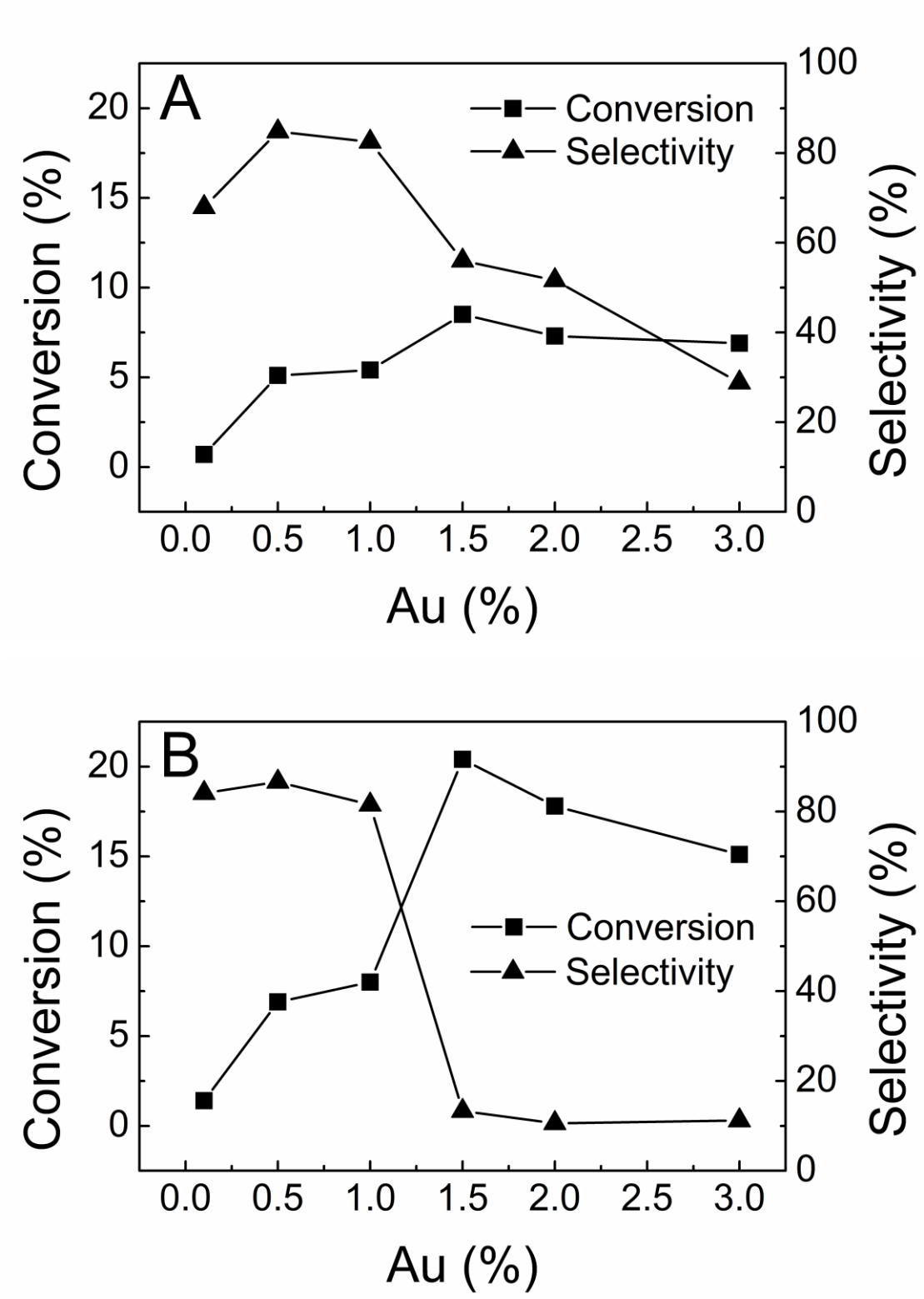

Figure S5. The influence of Au loading on the catalyst performance for the epoxidation of propylene. The catalysts with various Au loadings were prepared using TS-1-*syn* as supports by DPU method under default conditions. The catalysts were pre-reduced in H_2 at 250 ^{o}C for 1 h before the test. Reaction testing conditions: catalyst loading of 0.3 g, 150 ^{o}C, C_3H_6: O_2: H_2: N_2 = 1: 3: 9: 12, GHSV = 6600 ml h^{-1} g^{-1} (A) and 12000 ml h^{-1} g^{-1} (B).

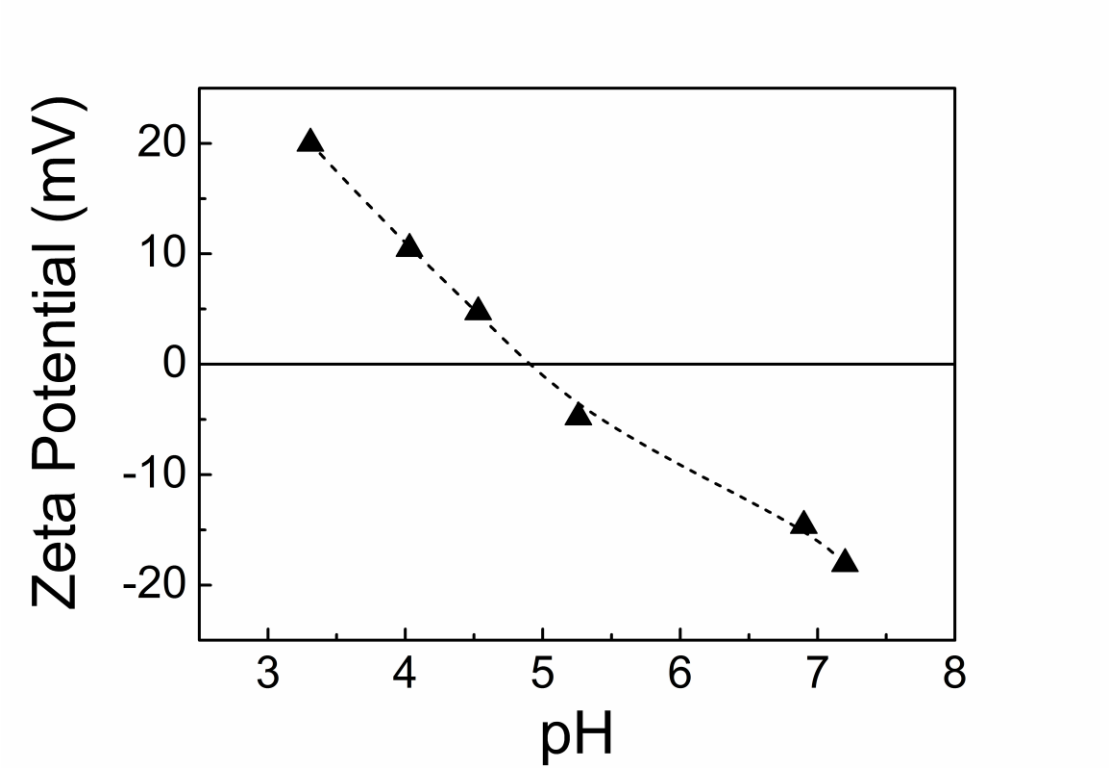

Figure S6. Electrophoresis result for TS-1-*syn* samples in KCl solution (1 mM). Line was added to guide the eye.

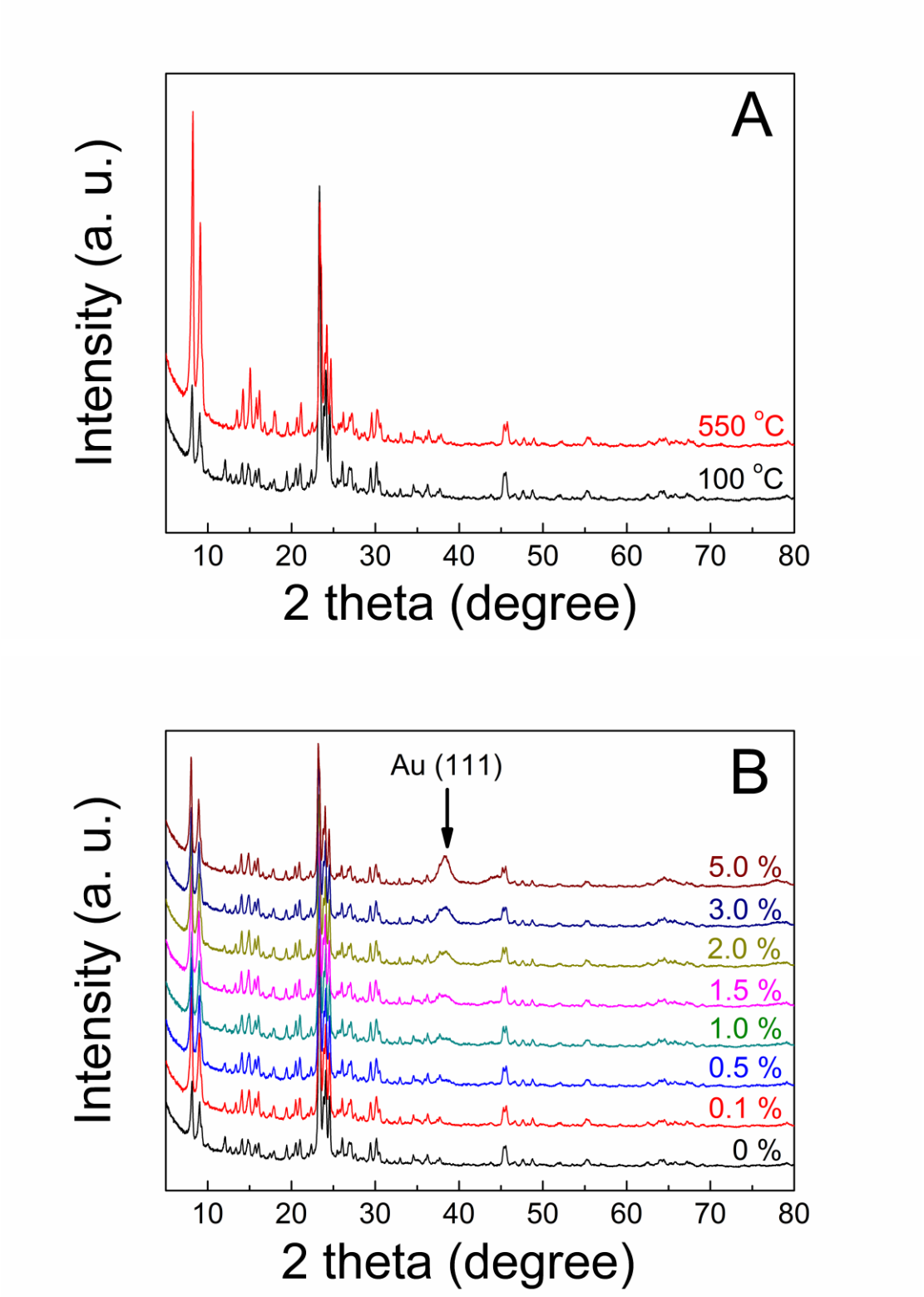

Figure S7. XRD patterns of TS-1 (A) and Au/TS-1-*syn* (B). (A) TS-1 zeolite before and after calcination, (B) Au/TS-1-*syn* with different Au loadings.

Table S1. The Au loadings in the Au/TS-1 catalysts prepared by DPU method.

Support	DPU			Au loading (wt%)		Fraction* (%)
	Temp. (^{o}C)	Time (h)	Urea/Au molar ratio	Theoretical	ICP-AES	
TS-1-*syn*	90	4.5	100	0.5	0.50	100
TS-1-*syn*	90	4.5	100	1.5	1.44	96
TS-1-*syn*	90	4.5	100	2.0	1.96	98
TS-1-*syn*	90	4.5	100	3.0	2.97	99
TS-1-*syn*	90	4.5	100	5.0	4.80	96
TS-1-*syn*	50	4.5	100	1.0	0.90	90
TS-1-*syn*	90	4.5	100	1.0	1.00	100
TS-1-*syn*	90	1.0	100	1.0	0.90	90
TS-1-*syn*	90	4.5	1	1.0	0.89	89
TS-1-*syn*	90	4.5	10	1.0	0.96	96
TS-1-*calc*	90	4.5	100	1.0	0.86	86

* The ICP-AES Au-loading divided by theoretical Au-loading.