Electronic Supplementary Information

Selective reductions using visible light photocatalysts of supported gold nanoparticles

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1. Influences of supports on reduction of styrene oxide with supported Au-NPs

Table S1. Influences of supports on reduction of styrene oxide with supported Au-NPs

Catalysts	Visible light				No light			
	Conversion		Selectivity		Conversion		Selectivity	
	(%)	(mol converted) $\cdot g(Au)^{-1} \cdot h^{-1}$	(%)	(mol formed) $\cdot g(Au)^{-1} \cdot h^{-1}$	(%)	(mol converted) $\cdot g(Au)^{-1} \cdot h^{-1}$	(%)	(mol formed) $\cdot g(Au)^{-1} \cdot h^{-1}$
Au/CeO$_2$	19.7	1.415×10^{-2}	88	1.245×10^{-2}	4.4	0.316×10^{-2}	72	1.019×10^{-2}
Au/ZrO$_2$	17.4	1.153×10^{-2}	72	0.830×10^{-2}	7.8	0.517×10^{-2}	75	0.865×10^{-2}
Au/TiO$_2$	22.5	1.629×10^{-2}	73	1.189×10^{-2}	7.8	0.565×10^{-2}	75	1.222×10^{-2}
Au/Al$_2$O$_3$	23.9	1.519×10^{-2}	60	0.911×10^{-2}	5.8	0.369×10^{-2}	51	0.774×10^{-2}
Au/Y	4.5	0.385×10^{-2}	62	0.239×10^{-2}	1.6	0.127×10^{-2}	55	0.212×10^{-2}

2. Apparent activation energy of photocatalysis

According to the first-order reaction rate equation, the values of the rate constants were calculated. Furthermore, the Arrhenius equation was applied to derive the apparent activation energies of the reductions via photocatalytic and thermal processes. The reference (X. G. Zhang, X. B. Ke, H. Y. Zhu, *Chem. Eur. J.* 2012, **18**, 8048) exhibited our recent work on how to estimate the activation energy of photooxidations of aromatic alcohols. The details of the calculation are given as follow.

At a certain temperature such as $25^{\circ}C$, the reaction rate generally holds out a first-order relation with the concentration of the reactant within the reaction time:

the original first-order rate law equation is: $-d(C)/dt = k(C)$

the integrated form of the first-order rate law equation is: $\ln[(C)/(C_0)] = -kt$, where,

(C) is the concentration of a reactant at any moment in time (e.g. styrene oxide); *(C_o)* is the initial concentration of this reactant; **k** is the constant for the reaction; and *t* is the time since the reaction started.

Here *(C)/(C_o) = 1-X_S* (*X_S* refers to the conversion of the reactant of styrene oxide). Then we can use the equation: $\ln[1-Xs] = -kt$ to calculate the constant for the reaction velocity according to the slope of the obtained straight line drawn by $\ln[1-Xs]$ to *t*.

In order to use Arrhenius Equation $\ln = \ln k_0 - (E_a/R)(1/T)$ to derive the activation energy E_a, in which *T* is the reaction temperature, various *k* values corresponding to various temperatures were obtained.