Supporting Information

Rapid preparation of TiO_{2-X} and its photocatalytic oxidation for arsenic adsorption under visible light

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Table S1. The phases and colors of samples prepared by static hydrogen reduction process. A certain amount of rutile-type H_2TiO_3 was placed in a corundum carrier and heated to a predetermined temperature in the furnace. After the reaction, the phase of the sample was detected by XRD and the color was recorded.

Sample Label	Experimental condition						Phases	Color
	Setting temperature	Original weight	Product weight	Holding time	Atmosphere	Gas flow rate		
Precursor	——	——	——	——	——	——	Anatase	White
S1	500℃	5g	4.11	6h	H_2	0.2L/min	Anatase	Yellowish
S2	600℃	5g	4.03	6h	H_2	0.2L/min	Anatase	Light blue
S3	700℃	5g	4.19	6h	H_2	0.2L/min	Anatase, Rutile	Light blue
S4	800℃	5g	4.17	6h	H_2	0.2L/min	Rutile	Gray
S5	900℃	5g	4.08	6h	H_2	0.2L/min	Rutile	Dark blue
S6	1000℃	5g	4.15	6h	H_2	0.2L/min	Rutile	Dark black

Table S2. The phases and colors of samples obtained by rapid preparation

Sample Label	Experimental condition			Phases	Color
	Setting temperature	Carry gas	Carry Gas flow rate L/min		
A-Ar 600	600℃	Ar	2.0	Anatase	Pale yellow
A-Ar 900	900℃	Ar	2.0	Anatase, Rutile	Light blue
A-Ar 1200	1200℃	Ar	2.0	Rutile	Gray
A-Ar 1500	1500℃	Ar	2.0	Rutile	Dark grey
R-Ar 600	600℃	Ar	2.0	Rutile	Pale yellow
R-Ar 900	900℃	Ar	2.0	Rutile	Light blue
R-Ar 1200	1200℃	Ar	2.0	Rutile	Gray
R-Ar 1500	1500℃	Ar	2.0	Rutile	Dark grey
A-H_2 600	600℃	H_2	2.0	Anatase	Pale yellow
A-H_2 900	900℃	H_2	2.0	Anatase, Rutile	Gray
A-H_2 1200	1200℃	H_2	2.0	Rutile	Dark blue
A-H_2 1500	1500℃	H_2	2.0	Ti_6O_{11}	Dark blue
R-H_2 600	600℃	H_2	2.0	Rutile	Pale yellow
R-H_2 900	900℃	H_2	2.0	Rutile	Gray
R-H_2 1200	1200℃	H_2	2.0	Ti_9O_{17}	Dark blue
R-H_2 1500	1500℃	H_2	2.0	Ti_6O_{11}	Dark blue

Note: A represents the anatase type of metatitanic acid as raw material and R represents the rutile type of metatitanic acid as raw material.

Table S3. Kinetics fitting parameters of arsenic adsorption

	Sample Label	Experimenl condition	Pseudo-second-order		
			R^2	qe（mg/g）	k_2（mg/g min）
As(III)	A-H_2 600	UV-vis	0.999	7.740	1.299
	A-H_2 600	Dark	0.999	11.865	1.020
	R-H_2 600	UV-vis	0.999	5.531	0.054
	R-H_2 600	Dark	0.999	12.604	0.087
As(V)	A-H_2 600	UV-vis	0.999	8.031	0.068
	A-H_2 600	Dark	0.999	8.083	0.089
	R-H_2 600	UV-vis	0.999	8.740	0.011
	R-H_2 600	Dark	0.999	8.280	0.014

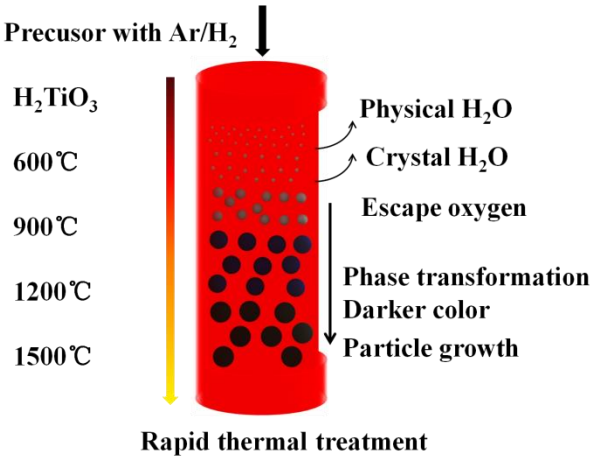

Figure. S1. A schematic of TiO_{2-X} formation in the reactor

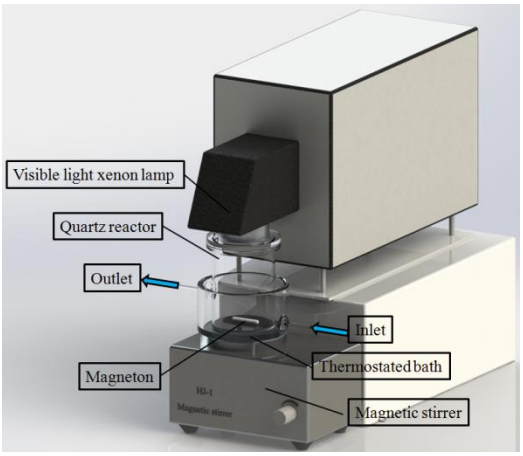

Figure. S2. A schematic of the arsenic adsorption experimental equipment

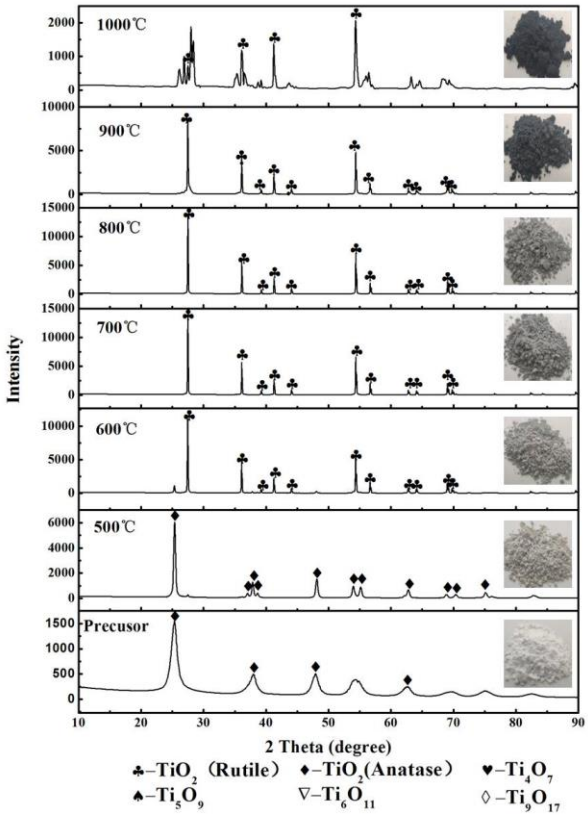

Figure. S3. XRD patterns of sample prepared by static hydrogen reduction under different conditions

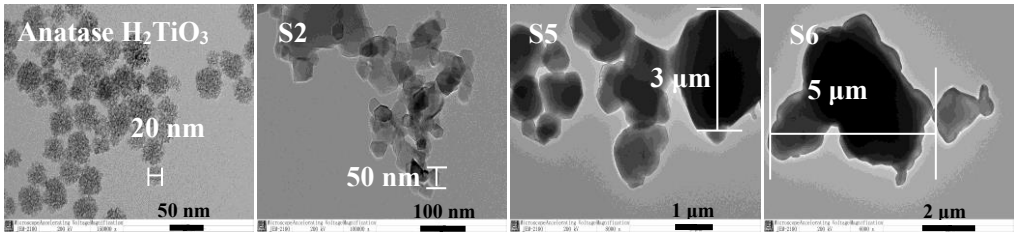

Figure. S4. The TEM images of S2, S5, S6 obtained by static hydrogen reduction

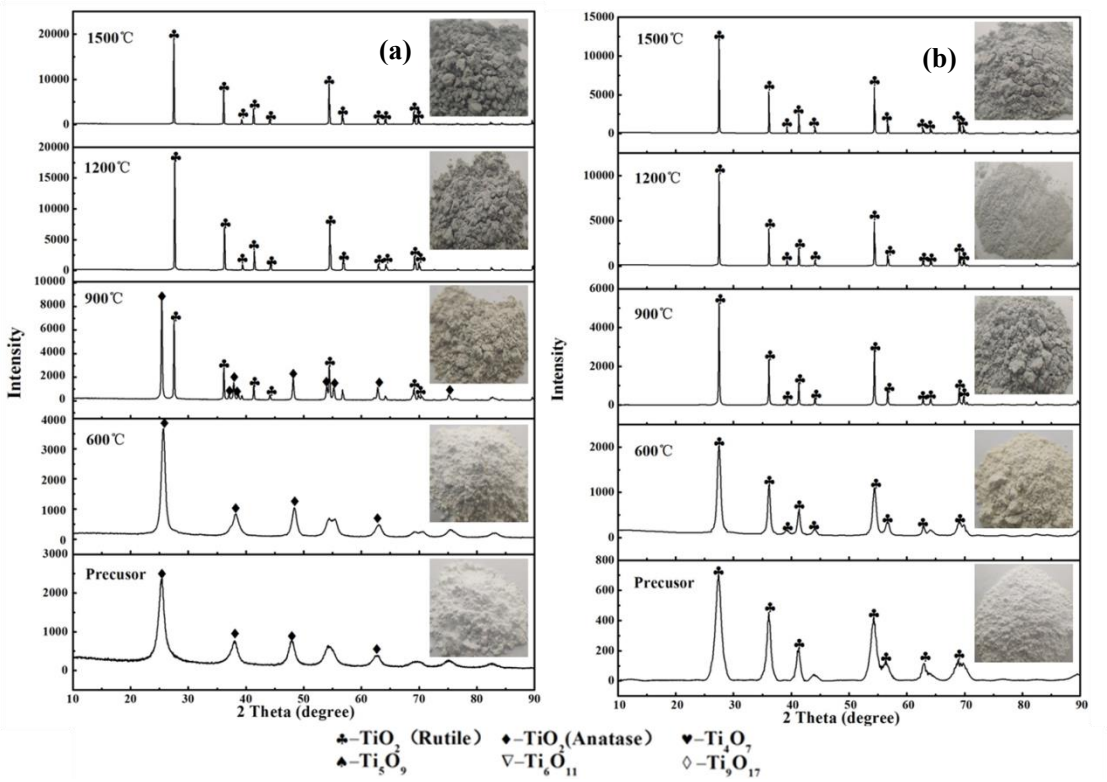

Figure. S5. XRD patterns of samples obtained by rapid preparation under Ar, (a)-anatase H_2TiO_3 as precursor, (b)-rutile H_2TiO_3 as precursor

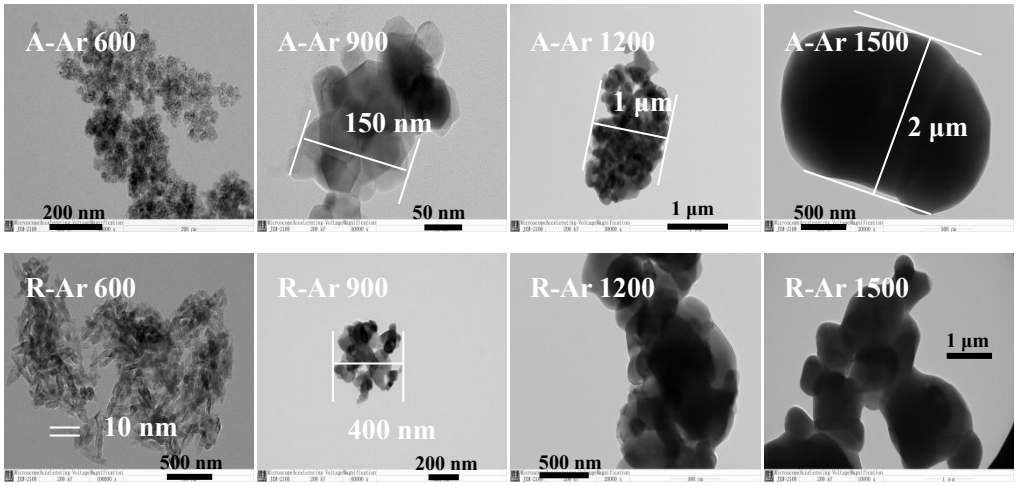

Figure. S6. The TEM images of precursor and samples obtained by rapid preparation under Ar atmosphere.

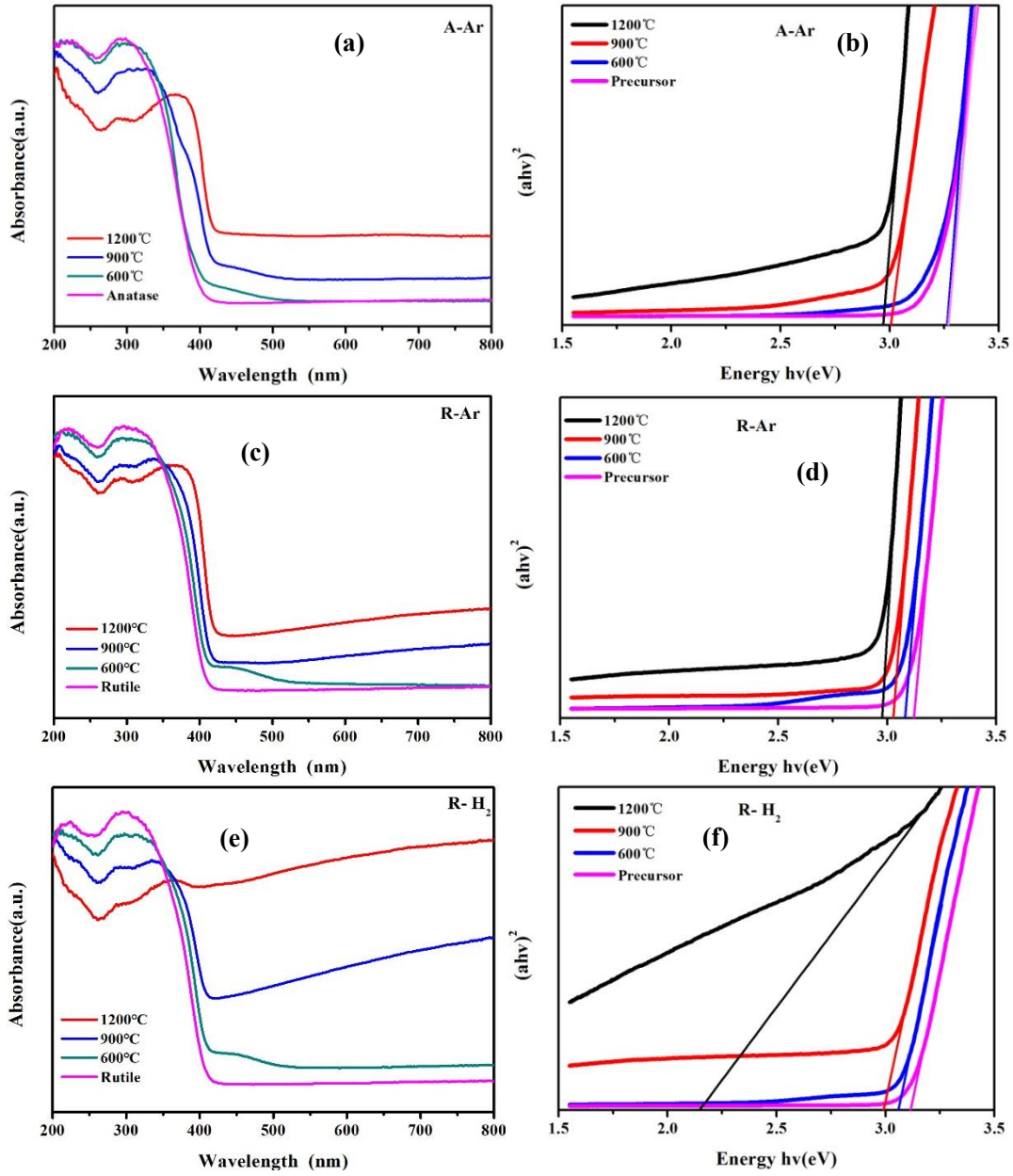

Figure. S7. Absorption spectrum and band gaps of samples: (a)-(c) and (d)-(f) were the absorption spectrum and band gaps fitting of sample, respectively.