Supporting Information

Facile Water-based Preparation of Rh-doped $SrTiO_3$ Nanoparticles for Efficient Photocatalytic H_2 Evolution under Visible Light Irradiation

Sayuri Okunaka,[†‡] Hiromasa Tokudome*[,†] and Ryu Abe*[,‡]

[†]Research Institute, TOTO LTD., 2-8-1 Honson, Chigasaki-City, Kanagawa-pref. 253-8577, Japan.

[‡]Graduate School of Engineering, Kyoto University, Katsura Nishikyo-ku, Kyoto 615-8510, Japan.

To whom corresponding author should be addressed.

Tel: +81-75-383-2478; Fax: +81-75-383-2478; E-mail: ryu-abe@scl.kyoto-u.ac.jp

1. Experimental

Preparation of $SrTiO_3$:Rh(2%) samples from the AA-sol with different polymer (polymethyl methacrylate latex particles and polyethylene glycol)

An aqueous solution of $Sr(OAc)_2$ containing lactic acid, AA-sol and an aqueous solution of $RhCl_3$ were mixed at the ratio of Sr : Ti : Rh = 1.00 : 0.98 : 0.02 and stirred for 1 hour at room temperature, yielding orange transparent sols. The sols were added by different polymers (polymethyl methacrylate latex particles (PMMA) and polyethylene glycol (PEG)) and stirred for 15 minutes at room temperature, then dried at 80°C for 3 hours, and finally calcined at 1000°C for 10 hours, yielding $SrTiO_3$:Rh(Rh: 2%) powders samples. These samples will be denoted as WH''-1000(PMMA) and WH''-1000(PEG) respectively.

Characterization

The particle sizes of titania colloids in sols were estimated by means of dynamic light scattering (DLS, ELSZ-1000, Otsuka Eletronics Co., Ltd). Thermal analysis (TG-DTA) was conducted on dried powders on a TG-8120 (Rigaku). TG-DTA curves were recorded under air flow in the temperature range from 25 to 1000°C.

2. Results

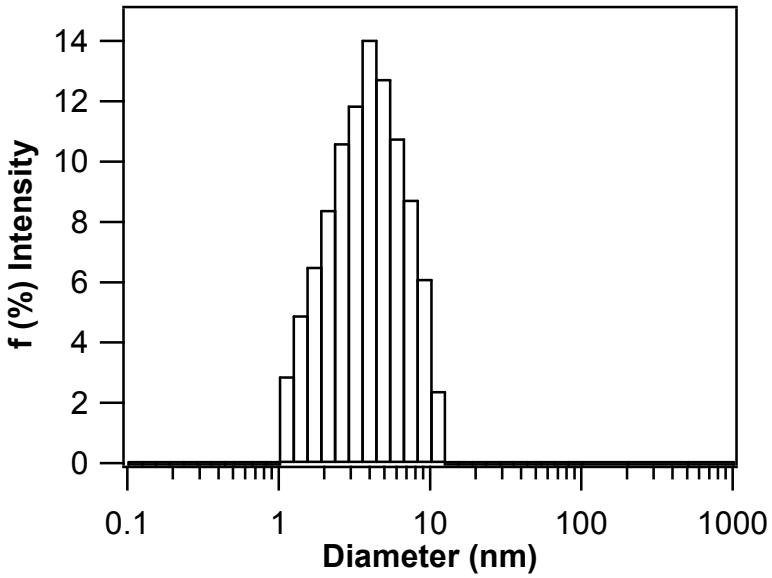

Fig. S1 Size distribution of the titania colloidal particles in AA-sols.

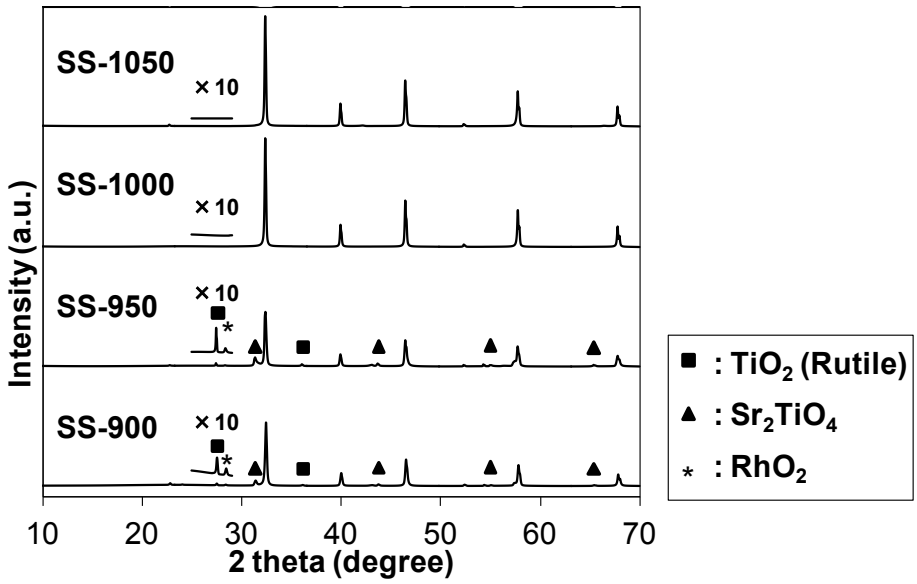

Fig. S2 XRD patterns of SS-particles ($SrTiO_3$:Rh2%) prepared at different calcination temperatures.

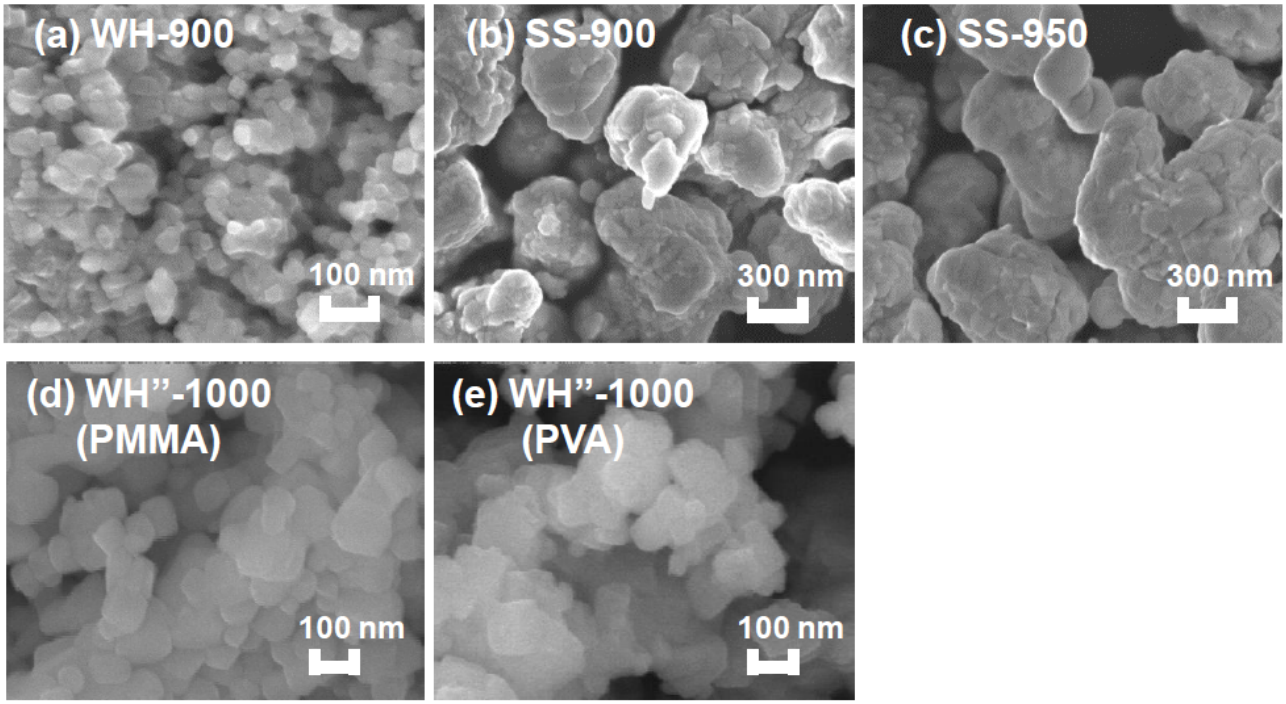

Fig. S3 SEM images of WH-particles ($SrTiO_3$:Rh2%, Sr/Ti = 1.02) (a), SS- and WH''-particles ($SrTiO_3$:Rh2%, Sr/Ti = 1.00) (b-e) prepared at different calcination temperatures.

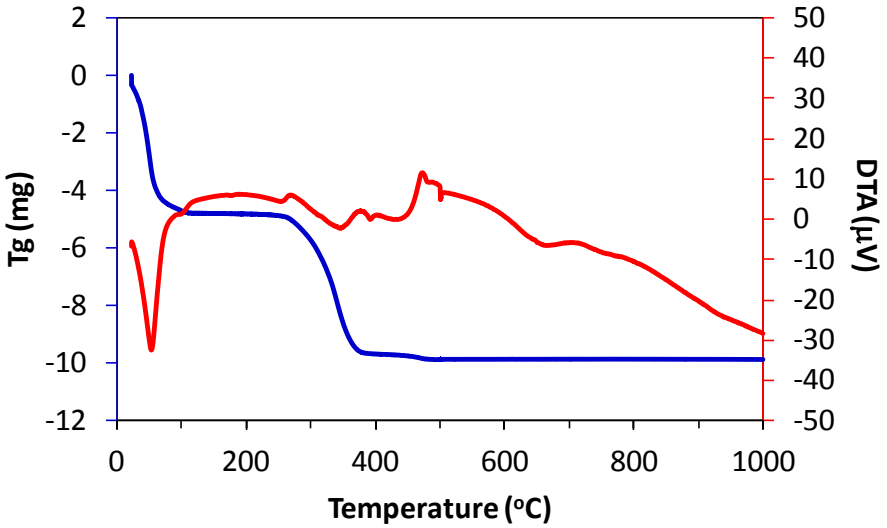

Fig. S4 TG-DTA curves of acrylic emulsion.

Table S1. H_2 evolution activity of $SrTiO_3$:Rh2% prepared *via* WH- and SS-method loaded with different amount of Pt cocatalyst.

	Amount of loaded Pt (wt%)	H_2 evolution (μmol h^{-1})
WH-1000 (Sr/Ti = 1.02)	0.1	32
	0.25	53
	0.5	87
	0.75	75
	1	66
	2	56
SS-1000 (Sr/Ti = 1.00)	0.1	1
	0.25	5
	0.5	11
	0.75	12

*Catalyst, 0.1 g; reactant solution, 200 mL of 10 vol % aqueous methanol solution; light source, 300 W Xe lamp with cutoff filters (λ > 410 nm).

Table S2. H_2 evolution from an aqueous methanol solution under visible light irradiation of $SrTiO_3$:Rh(2%) photocatalyst prepared upon different doping amount.

	Amount of doped Rh ion (%)	H_2 evolution (μmol h^{-1})
WH-1000 (Sr/Ti = 1.02)	1	50
	2	87
	3	77
SS-1000 (Sr/Ti = 1.03)	1	15
	2	12

*Catalyst, 0.1 g; reactant solution, 200 mL of 10 vol % aqueous methanol solution; light source, 300 W Xe lamp with cutoff filters (λ > 410 nm).