

Supplementary data

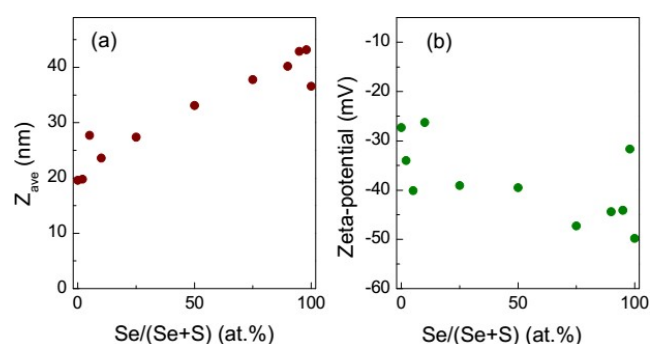
# Colloidal and Deposited Products of the Interaction of Tetrachloroauric Acid with Hydrogen Selenide and Hydrogen Sulfide in Aqueous Solutions

Sergey Vorobyev<sup>1</sup>, Maxim Likhatski<sup>1</sup>, Alexander Romanchenko<sup>1</sup>, Nikolai Maksimov<sup>1</sup>, Sergey Zharkov<sup>2,3</sup>, Alexander Krylov<sup>2</sup>, and Yuri Mikhlin<sup>1,\*</sup>

<sup>1</sup> Institute of Chemistry and Chemical Technology of the Siberian Branch of the Russian Academy of sciences, Krasnoyarsk, Russia; \* yumikh@icct.ru

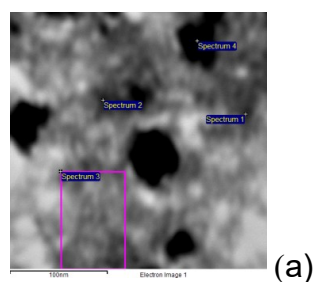
<sup>2</sup> Kirensky Institute of Physics of the Siberian Branch of the Russian Academy of sciences, Krasnoyarsk, Russia

<sup>3</sup> Siberian Federal University, Krasnoyarsk, Russia

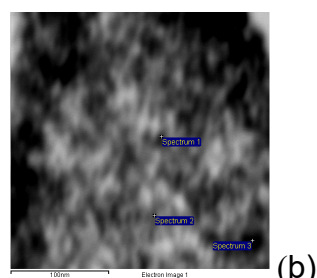


**Figure S1.** Hydrodynamic diameters  $Z_{av}$  and zeta potentials of the colloidal species at various ratios  $H_2Se$  and  $H_2S$  to  $HAuCl_4$  determined in 10 min after the mixing.

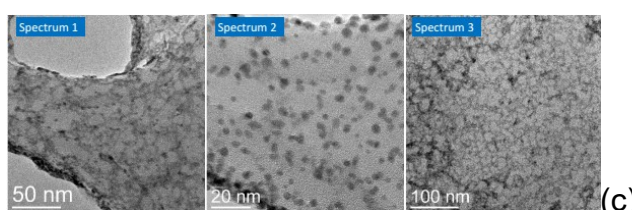
Point	Se	Au
Spectrum 1	69.3	30.7
Spectrum 2	57.6	42.4
Spectrum 3	63.6	36.4
Spectrum 4	45.0	55.0



Points	S	Se	Au
Spectrum 1	25.8	16.0	58.2
Spectrum 2	15.8	16.7	67.5
Spectrum 3	25.3	16.6	58.1



Point	S	Au
Spectrum 1	63.2	36.8
Spectrum 2	20.7	79.3
Spectrum 5	50.4	49.6



**Figure S2.** EDS analysis data (normalized at.%, contents of Cl of 5–6% in all the samples are omitted) and STEM images of the products deposited from aqueous solutions of (a) 0.3 mmol/L HAuCl<sub>4</sub> + 0.9 mmol/L H<sub>2</sub>Se, (b) 0.3 mmol/L HAuCl<sub>4</sub> + 0.45 mmol/L H<sub>2</sub>Se + 0.45 mmol/L H<sub>2</sub>S; (c) 0.3 mmol/L HAuCl<sub>4</sub> + 0.9 mmol/L H<sub>2</sub>S after 1 h reaction.

**Table S1.** Atomic ratios (relative to gold) and fitting parameters for Au 4f, Se 3d, S 2p spectra: binding energies for Au 4f<sub>7/2</sub>, Se 3d<sub>5/2</sub>, S 2p<sub>3/2</sub> and percentages of the band areas derived from XPS.

Sample Preparation	Au 4f		Se 3d		S 2p		N 1s
		eV (%)		eV (%)		eV (%)	
HAuCl <sub>4</sub> + 3H <sub>2</sub> Se	1.0	84.1 (73.4)	1.03	54.2 (24.1)	-	-	-
		85.3 (22.9)		54.9 (59.4)			
		86.4 (3.7)					
HAuCl <sub>4</sub> + 3H <sub>2</sub> Se +CTAB before washing	1.0	84.2 (65.3)	0.90	54.4 (45)	-	-	2.7
		85.4 (29.2)		54.9 (55)			
		86.4 (5.5)					
HAuCl <sub>4</sub> + 3H <sub>2</sub> Se +CTAB, washed	1.0	84.2 (71.0)	1.0	54.2 (29.4)	-	-	0.16
		85.4 (25.2)		54.9 (55.3)			
		86.6 (3.8)					
HAuCl <sub>4</sub> + 1.5H <sub>2</sub> Se + 1.5H <sub>2</sub> S	1.0	84.1 (79.5)	0.58	54.1 (19.6)	0.54	161.6 (9.1)	-
		85.3 (17.3)		54.7 (49.0)		162.5 (20.5)	
		86.2 (3.2)				168.6 (2.6)	
HAuCl <sub>4</sub> + 3H <sub>2</sub> S	1.0	84.2 (89.1)	-	-	1.32	161.8 (17.5)	-
		85.6 (8.3)				163.0 (75.4)	
		86.3 (2.6)				167.7 (7.1)	
HAuCl <sub>4</sub> + 3H <sub>2</sub> S H <sub>2</sub> Se +	1.0	84.16 (86.3)	0.20	53.9 (9)	0.85	161.8 (14)	-
		85.5 (11.0)		55.0 (31)		162.8 (60)	
		86.3 (2.7)		54.7 (60)		169.0 (1.6)	
Se powder	-	-	1.0	54.7 (60)	-	-	-
				55.3 (40)			