Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Electronic Supplementary Material

Genesis of Pure Se(0) Nano- and Micro- structures in Wastewater with Nanoscale Zero-Valent Iron (nZVI)

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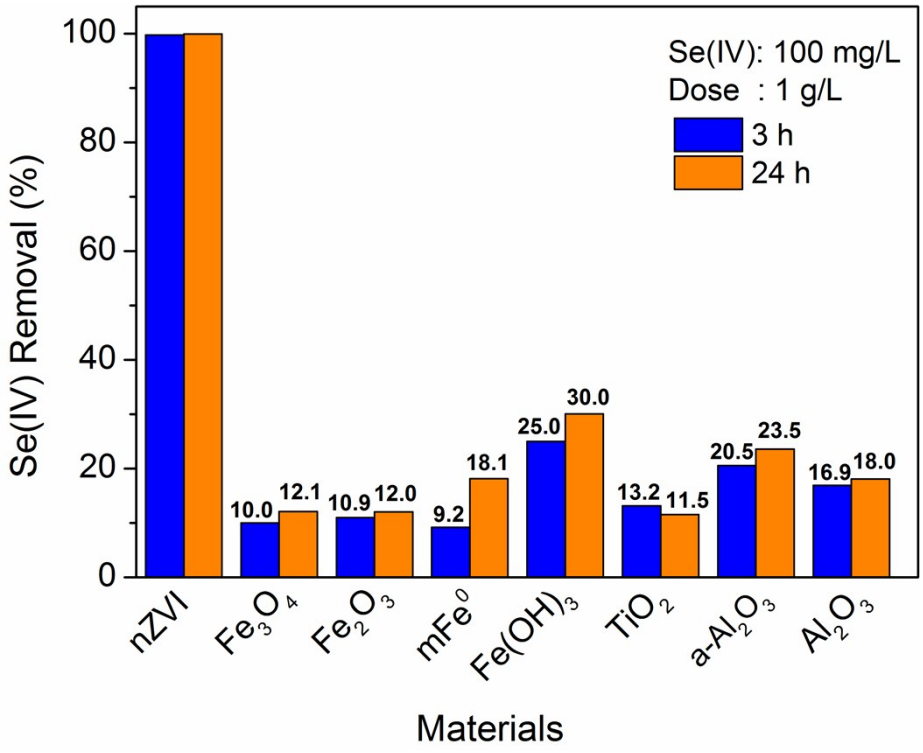


FigureS1. Comparison of various materials on Se(IV) removal. Reactions: 1 g/L solids concentration, 100 mg/L Se(IV) at pH 7.0 in 35 ml DI water for 3 h and 24 h.

Table S1

Characteristics of the materials used in the present study

Material	Particle size	Specific surface area (m^2g^{-1}) From N_2 adsorption, BET calculation
nanoscale zero-valent iron (nZVI)[a]	~100 nm	20-60
magnetite (Fe_3O_4)[b]	< 50 nm	> 60
iron oxide (Fe_2O_3)[b]	< 50 nm	50-245
micro iron powder (mFe^0)[c]	100 mesh	0.09
ferric hydroxide ($Fe(OH)_3$)[c]	AR, Aladdin	> 80
titanium oxide (TiO_2, rutile)[b]	< 100 nm	130-190
aluminum oxide (Al_2O_3)[d]	~ 150 mesh	155
activated aluminum oxide (a- Al_2O_3)[d]	60-80 nm	> 40

[a] Data from ref 32; [b] Data supplied by Sigma-Aldrich; [c] Data supplied by Aladdin; [d]Data supplied by Sinopharm Chemical Reagent (Shanghai, China).

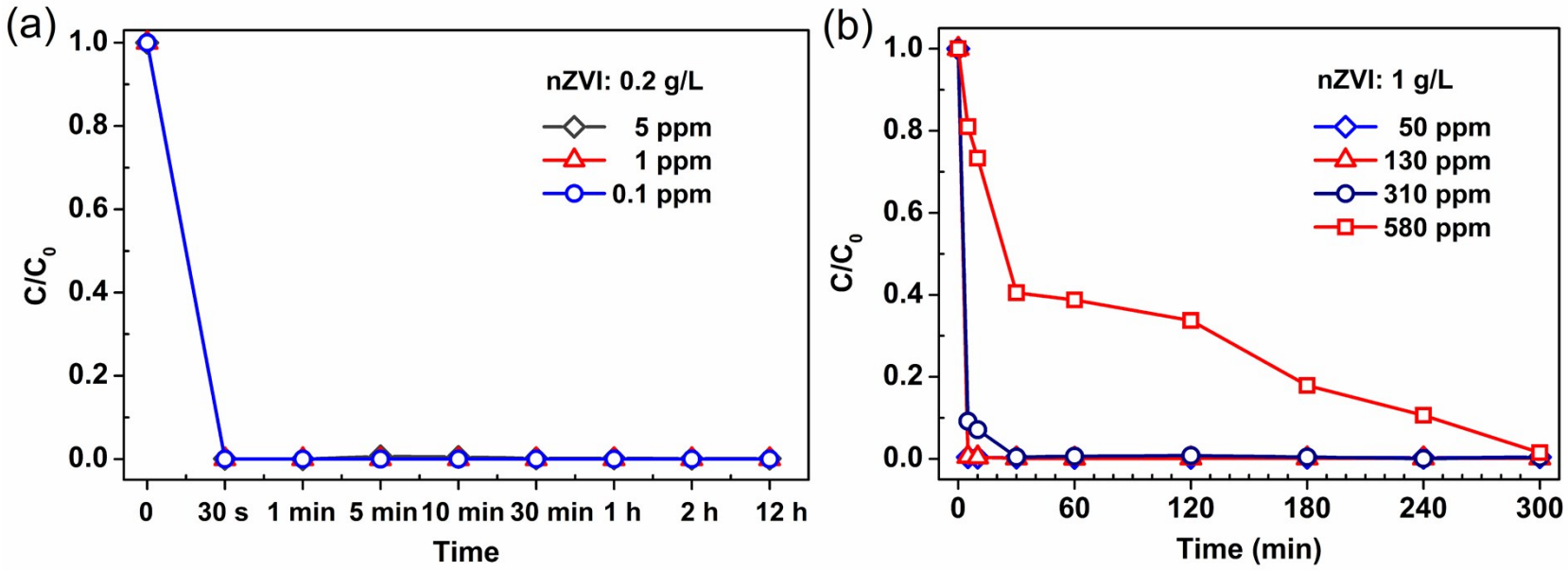
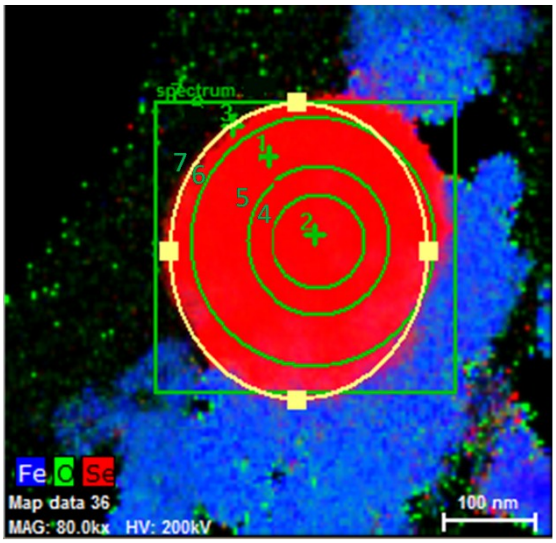


Figure S2. Effect of initial concentrations on Se(IV) removal. Initial solution pH was 7.0.



Mass-% (norm.)	Area	DF4	Fe-KA	O	C-KA	Se-KA
1	1	49371	0.00	2.84	5.48	91.68
2	1	64248	2.44	0.42	0.00	97.13
3	1	21283	0.00	3.09	71.50	25.42
4	7236	64018	2.15	0.94	0.05	96.86
5	17194	62608	2.00	0.97	0.07	96.95
6	50648	55959	3.64	1.59	1.08	93.70
7	63078	51867	4.72	2.04	2.86	90.37

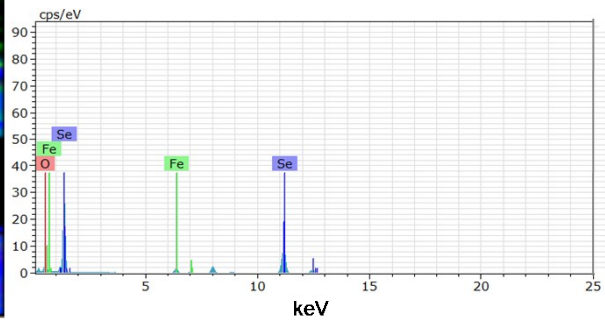
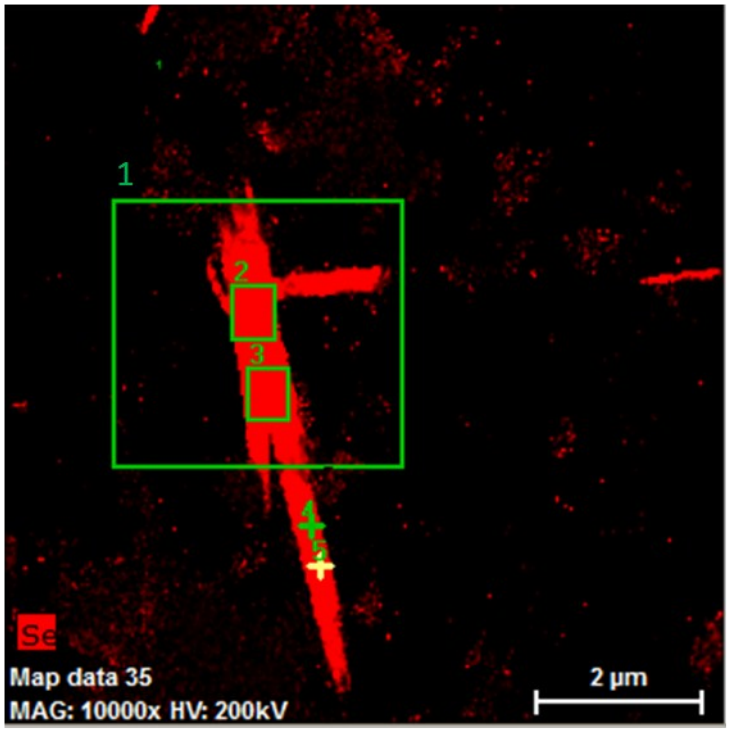


Figure S3. EDS quantitative analysis of the Se(0) nanosphere.



Mass-% (norm.)	Area	DF4	Fe-KA	O	C-KA	Se-KA
1	151875	11695	16.06	11.22	38.82	33.89
2	3834	53381	0.80	0.74	0.34	98.13
3	3710	53670	0.90	0.64	0.06	98.40
4	1	60228	0.00	0.00	0.00	100.00
5	1	57804	0.54	0.26	0.00	99.20

Figure S4. EDS quantitative analysis of Se(0) nanoneedles.

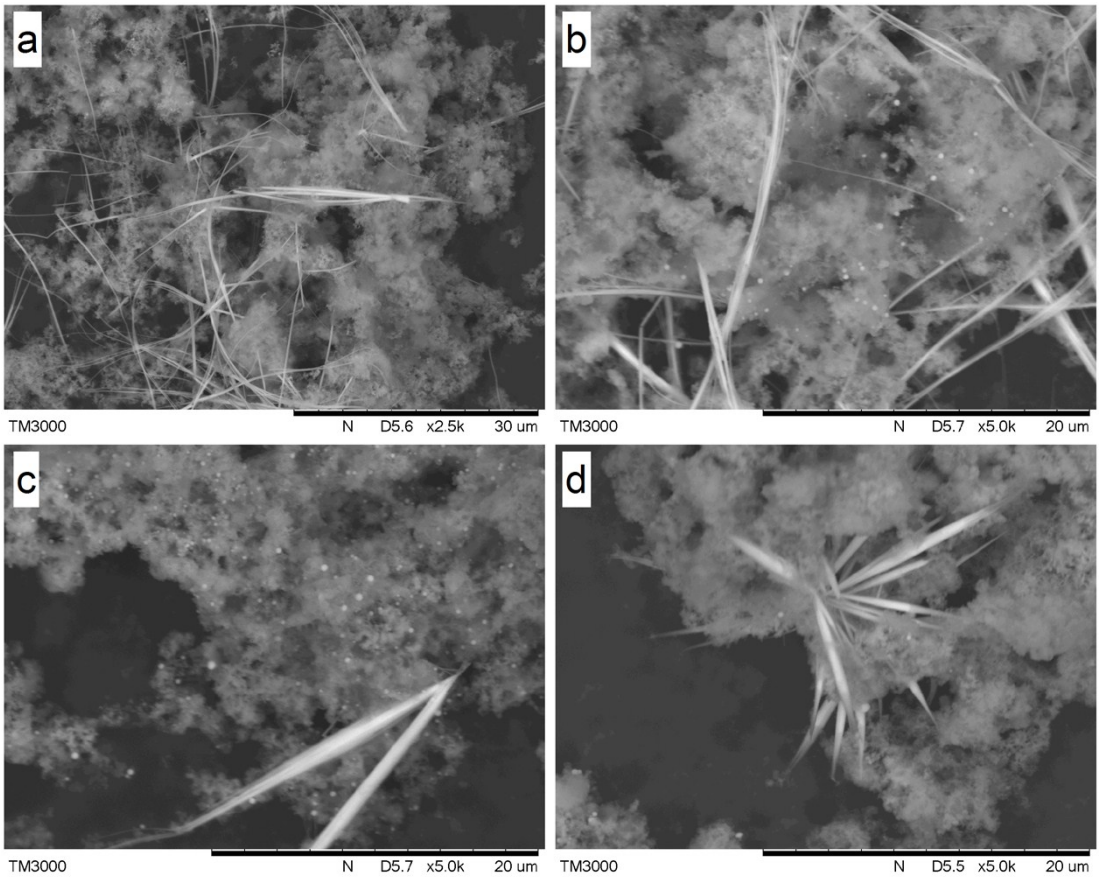


Figure S5 SEM imagines of nanoparticles after (a) 10 min; (b) 40 min; (c) 3 h; (d) 24 h reactionbetween nZVI (0.5 g/L) and Se(IV) (100 mg/L).

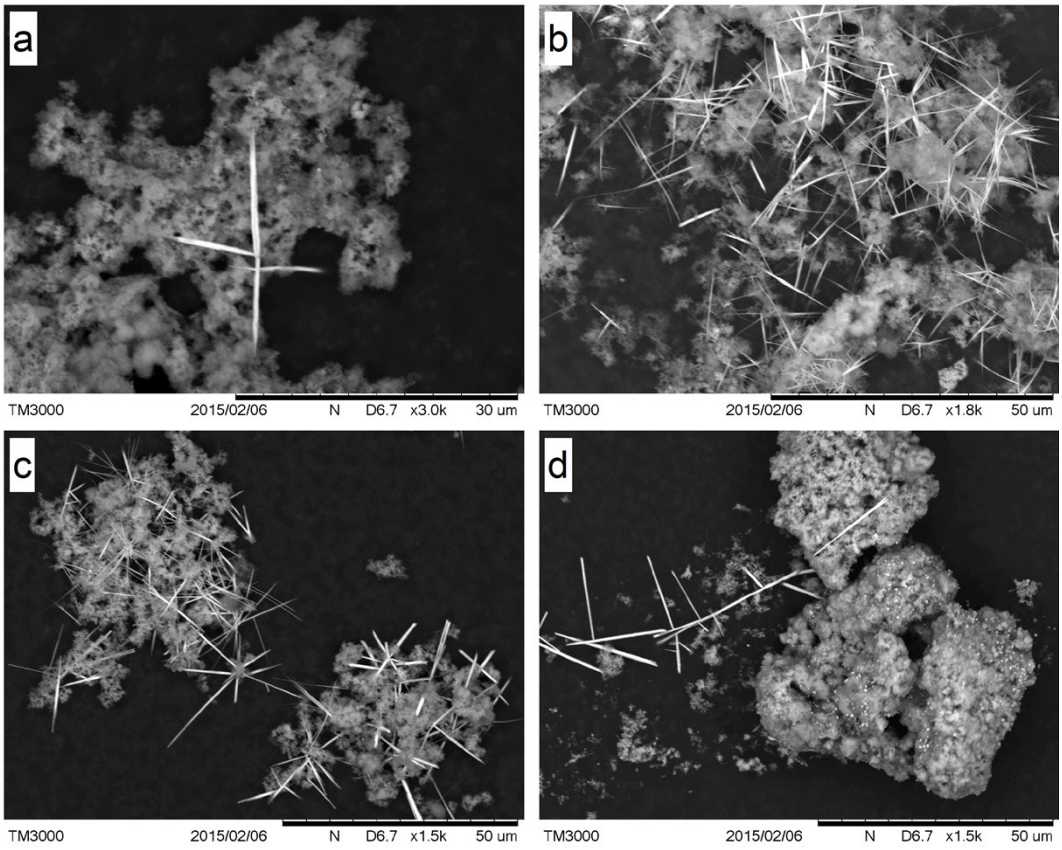


Figure S6 SEM imagines of nanoparticles after 3 h reaction between nZVI (0.5 g/L) and Se(IV) ((a) 55 mg/L; (b) 150 mg/L; (c) 550 mg/L; (d) 1000 mg/L).

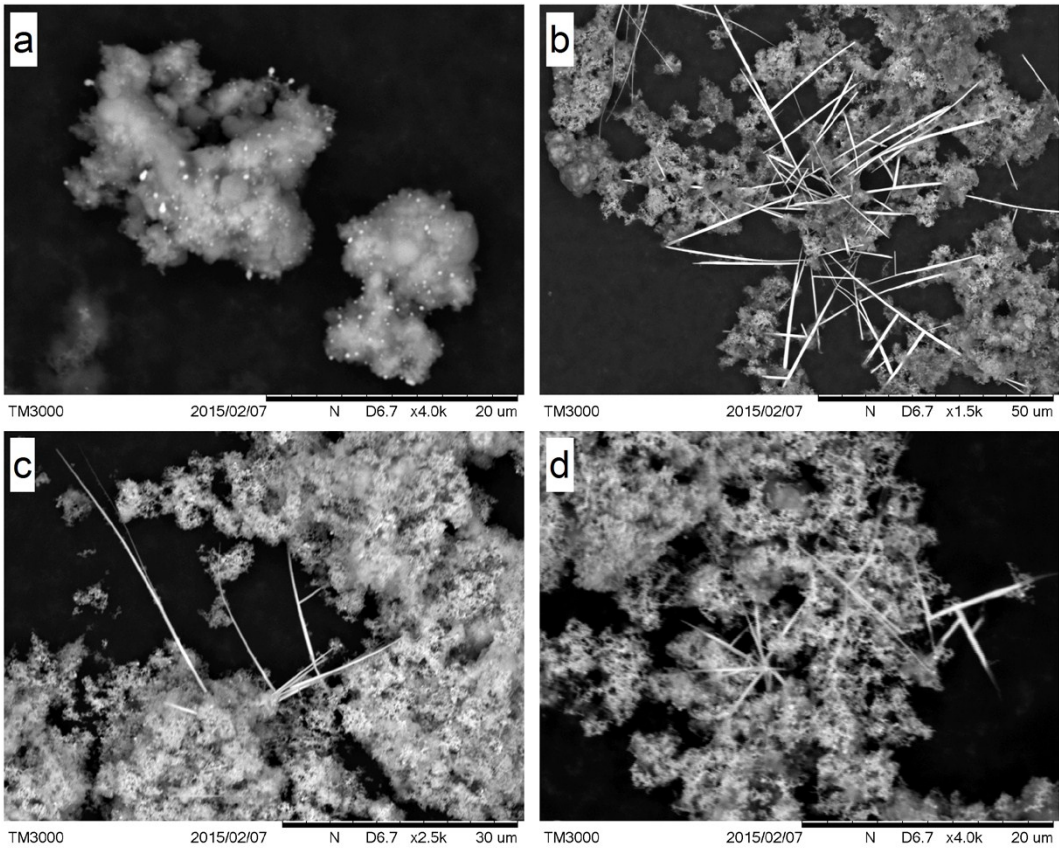


Figure S7 SEM imagines of nanoparticles after 3 h reaction between nZVI ((a) 0.2 g/L; (b) 1.0 g/L; (c) 1.5 g/L; (d) 5.0 g/L) and Se(IV) (100 mg/L).

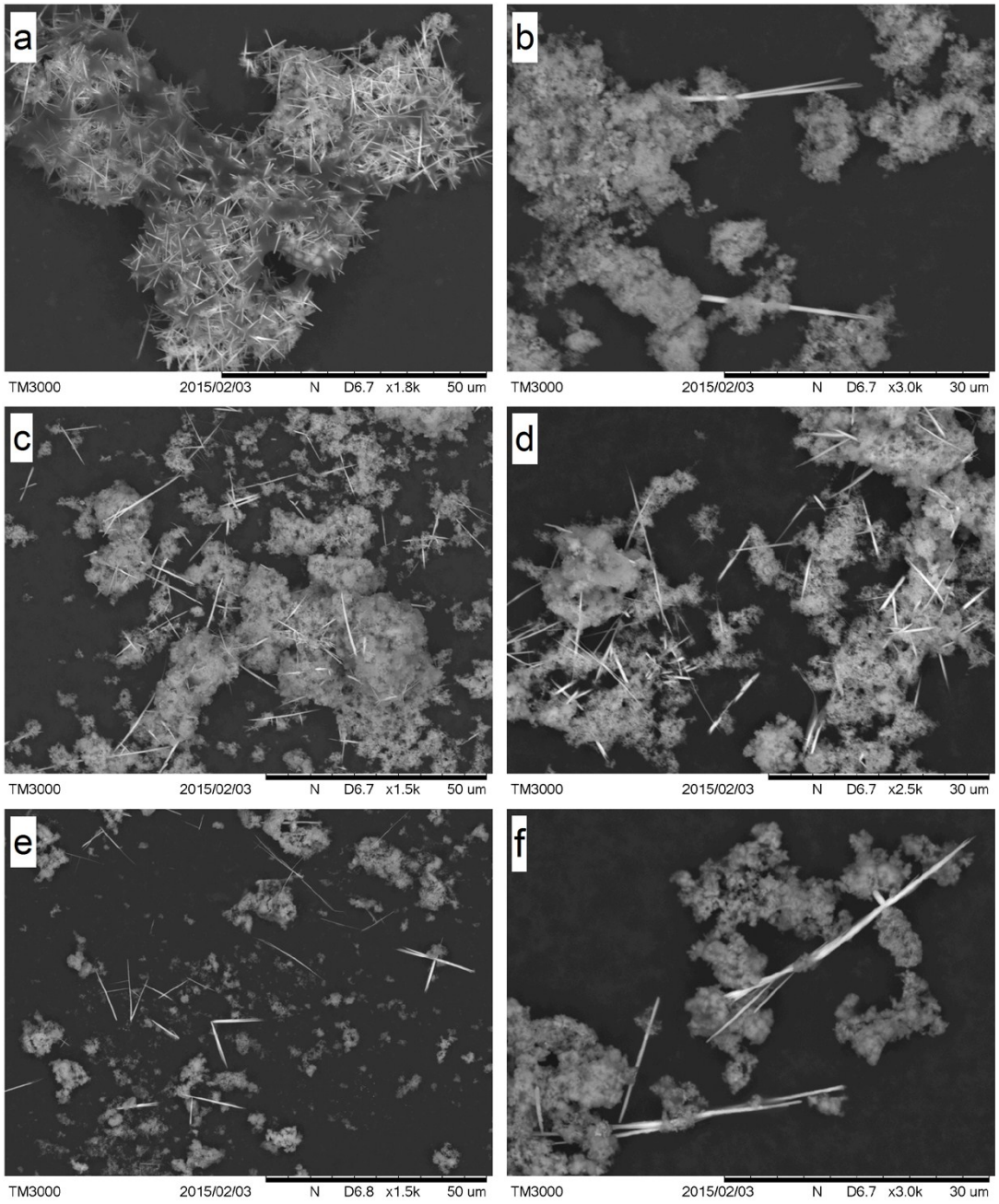


Figure S8 SEM imagines of nanoparticles after 24 h reaction between nZVI (0.5 g/L) and Se(IV) (100 mg/L) at different initial pH （(a) pH= 2；(b) pH= 4；(c) pH= 6；(d) pH= 8；(e) pH= 10；(f) pH= 12）.

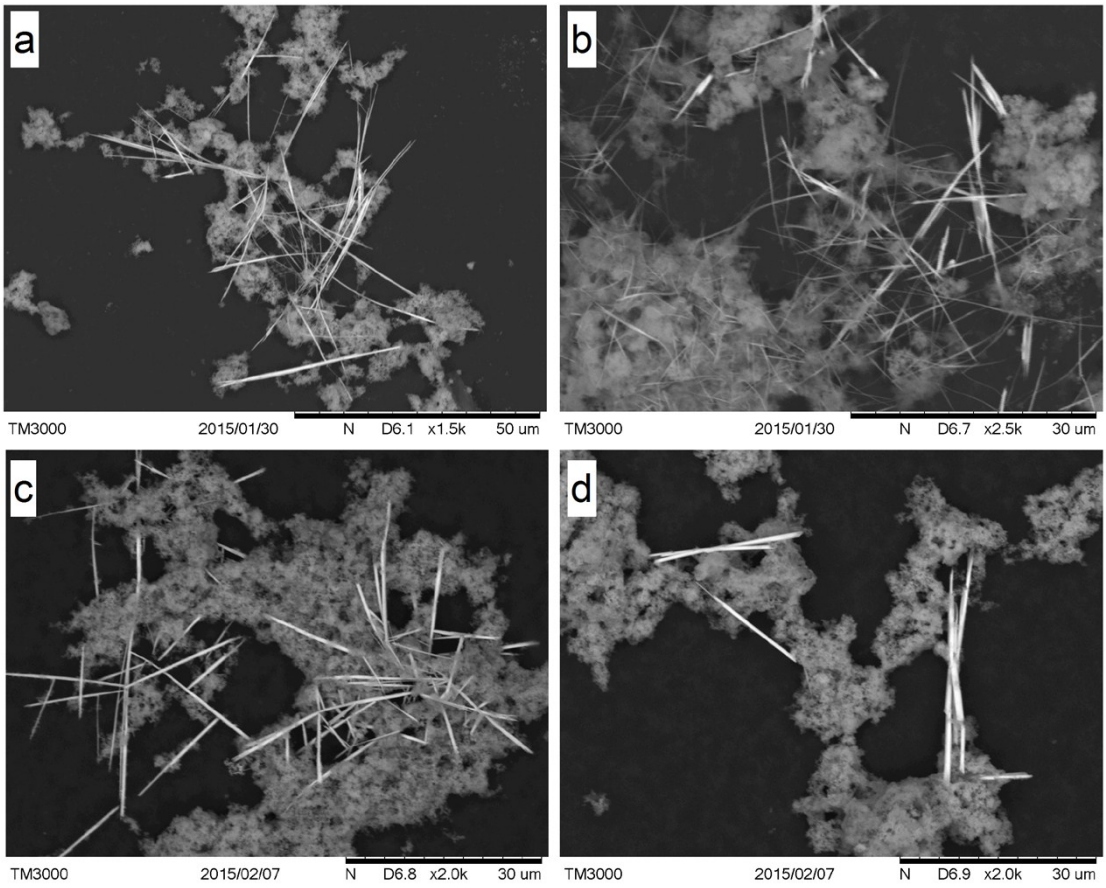


Figure S9 SEM imagines of nanoparticles after 3 h reaction between nZVI[0.5 g/L) and Se(IV) (100 mg/L) at different temperature ((a)15 °C；(b) 25 °C；(c) 35 °C；(d) 45 °C).