Soil & Groundwater Remediation
Materials Manufacturer

With our precise &strict production control, we are able to achieve precise size control and stable batch production, which brings high chemical reactivity and purity for our ZVI powder.

We can supply a comprehensive series of metal powder to meet needs among different sites and application of soil & groundwater remediation.

Why choose US

01 **ISO 9001 certified manufacturer.**

02 **Implementation of environmental protection concept in our metal powder and production process.**

03 **Quality and service are recognized by our customers worldwide.**

04 **Our metal powder can be widely applied in industry of soil & groundwater remediation, PM, diamond tools, electronic components, etc.**

Zero Valent Iron (ZVI)

Zero Valent Iron (ZVI) is a green & eco-friendly material, which can be used as a reducing agent in the environment remediation process. ZVI can remove various contaminants by chemical reduction, adsorption and co-precipitation. Furthermore, ZVI could also be combined with bioremediation to significantly improve the remediation efficiency.

Our ZVI are made by a unique chemical method, with particle size range of 2 μm - 250 μm.

Compared with conventional ZVI powder, our ZVI powders have the characteristics of

- large specific surface area
- high reaction activity
  (>50 times higher than conventional ZVI)
- good adsorption capacity
- high purity (no harmful heavy metals)
- strong reduction property (ORP can reach -400mV)
- good longevity

which could significantly improve the removal efficiency of contaminants such as chlorinated solvent, hexavalent chromium in soil and groundwater, and shorten the environmental remediation time.

Check out our products . . .

Our UIF (0.5-5μm) has been used in EZVI technology in U.S. environmental market since 2004. Our UIF is well received by customers who we maintain long-term relationships with since then. Our spherical porous iron powder (50-250μm) has the features of high reactivity, high porosity, high permeability and low activity loss, is suitable for soil mixing, in situ injection and permeable reaction barrier (PRB). In addition, we also have UH, HH and other ZVI products for different sites and construction methods.

With our professional product R&D team, we have the capacity of customizing products according to customers' needs.

Examples of Contaminants Treated

Ni/Fe Bimetal

PCB

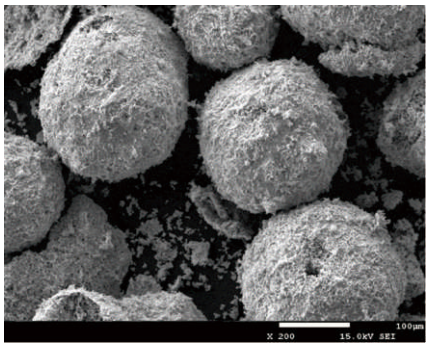
- **Chlorinated solvents**
  (e.g., PCE, TCE, 1,1-DCE, *cis*-DCE, *trans*-DCE, VC)
- **Chlorobenzenes**
- **Energetic compounds**
- **Most pesticides & herbicides**
- **Nitrate compounds**
- **Heavy metals** • **DNAPL** • **Dyes**

Spherical Porous Iron Powder

Characteristic

- High reactivity & large specific surface area (>50 times the conventional ZVI)
- High porosity & good permeability and adsorption performance & wide range of application
- Low activity loss & good longevity for increased reliability and shorten the environmental remediation time
- Customized particle size range for different applications/sites

SEM-VIEW



Grade	Geometry	Mesh	Bulk Density (g/cm^3)	Tap Density (g/cm^3)	Chemical analysis	Application
EG-040	Spherical & Porous	40-100	0.44	0.67	Fe ⩾99.08 O ⩽0.22	• PRB • Soil Mixing
EG-100	Spherical & Porous	100-200	0.61	0.97	Fe ⩾99.08 O ⩽0.57	• Water Treatment • Soil Mixing
EG-200	Spherical & Porous	-200	0.65	0.98	Fe ⩾99.08 O ⩽0.38	• Injection • Soil Mixing

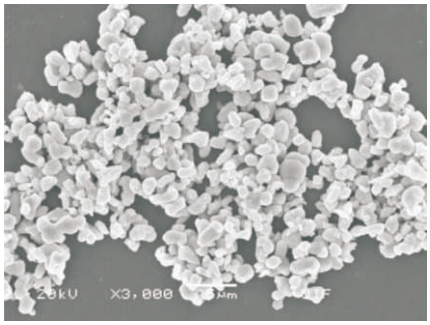
UIF

Our UIF has been used in EZVI technology in the U.S. environmental market since 2004, which is well received by customers who we maintain long-term relationships with since then. The light weight of UIF helps the formation of suspension, maintenance of EZVI stable water in oil emulsified structure. UIF with spheroidal geometry could help to reduce the internal friction and improve the diffusion of EZVI.

Characteristic

- Spheroidal geometry
  Well controlled particle size between 0.5-5 μm
- High specific surface area, reduction property, chemical reactivity and adsorption performance
- Helps to form the water in oil suspension and the diffusion of EZVI
- Significantly improve the remediation efficiency

SEM-VIEW



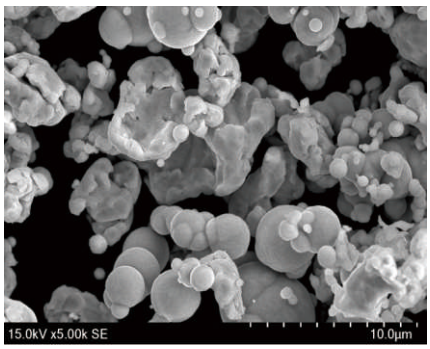
Grade	Geometry	Particle Size Distribution D10	D50	D90	Apparent Density (g/cm^3)	Tap Density (g/cm^3)	Chemical analysis	Application
UIF	Spheroidal	1.1μm	2.55μm	4.21μm	0.90	2.16	Fe ⩾98.55 O ⩽0.80	• EZVI

Ni/Fe Bimetal

Characteristic

- Fe is the main component while Ni contained 5~25% Customizable by application/site
- Higher reactivity compare with ZVI
- Uniform distributed of bimetallic elements with good stability
- Microcell electrolysis, could significantly improve the treatment efficiency of sewage
- Ni is recyclable

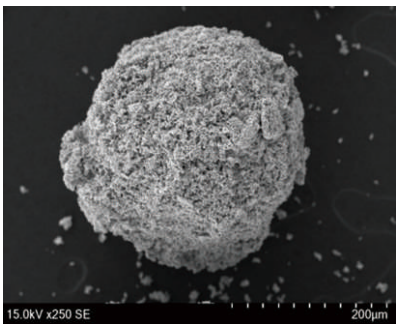
SEM-VIEW



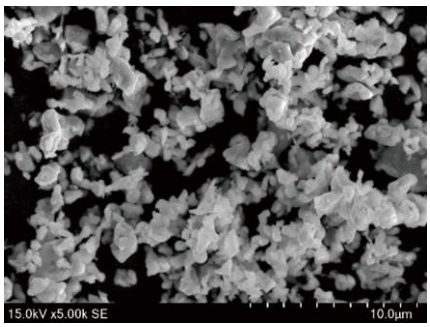
Grade	Geometry	Particle Size Distribution D10	D50	D90	Apparent Density (g/cm^3)	Tap Density (g/cm^3)	Chemical analysis		Application
EG-955	Irregular	2.75-3.18 μm	5.05-5.45 μm	8.13-8.59 μm	1.27	2.50	Fe Ni	Main Component 5	• Water Treatment

UH / HH

UH: SEM-VIEW



HH: SEM-VIEW



Grade	Geometry	Mesh	Apparent Density (g/cm^3)	Tap Density (g/cm^3)	Chemical Analysis		Application
UH	Spheroidal	-60 mesh	0.65-0.75	1.05-1.20	Fe O	⩾98.80 ⩽0.55	• Water Treatment • Soil Mixing

Grade	Geometry	Particle Size Distribution D10	D50	D90	Apparent Density (g/cm^3)	Tap Density (g/cm^3)	Chemical Analysis		Application
HH	Irregular	0.68-0.74 μm	1.21-1.50 μm	2.24-2.91 μm	0.76-0.88	2.01-2.35	Fe O	⩾95.00 ⩽3.00	• Water Treatment • Soil Mixing

Laboratory Test 1

Laboratory tests were conducted by an independent, third-party to assess ZVI reactivity with PCE under batch conditions, and there are four conventional ZVI were selected for making a comparison (Table 1). In brief, all ZVI materials were acid-rinsed with 0.10 N HCl solution (2:1 L:S by volume) for 2 hours, rinsed with deionized water, and then vacuum filtered on 0.45 µm filter paper. A total of 10 g wet ZVI was immediately placed in 20 ml VOA vials with 3.45 ml DI water containing 0.3 ml of PCE-saturated DI water (1.5:1 L:S by volume) yielding an initial PCE concentration of 1,940 µg/L (based on data from control microcosms that contained no ZVI) and sealed with Teflon-lined caps. Moisture content measured on separate aliquots following drying in N2-atmosphere desiccator determined ZVI dry weight. Replicate aliquots were obtained from each reaction vessel after 72 hours incubation and analyzed for chlorinated ethenes, ethene/ethane and acetylene using GC-PID (headspace). Change in pH and ORP were also measured. After 72 hours incubation the microcosms were re-spiked with an additional 1,780 µg/L of PCE and incubated for an additional 96 hours (168 hours total reaction time).

Over the first 72 hr incubation period there was a clear correlation between ZVI surface area and PCE transformation rates, with the smallest ZVI particles (UIF ca. 2.55 micron ZVI) exhibiting the fastest PCE removal rate of 10.58 µg/L per g ZVI/hr (Table 1). For example, ZVI degradation kinetics can reflect declining rate patterns over time resulting from interspecies competition from catabolites and occlusion of the reactive surfaces via ferrous iron and oxyhydroxide passivation. Indeed, during the short course of these studies, the smaller ZVI particles lost more of their reactivity than larger ones as measured in terms of PCE transformation kinetics.

Table 1 ZVI Reactivity as Change/Decrease in PCE Removal (µg/L per g ZVI/hr)

		UIF	ZVI-A	ZVI-B	ZVI-C	ZVI-D
Ave. Size (µm)		**3**	45	297	125	297
Ave. Size (mesh)		**>5000 - <2500**	>1200 - <170	>170 - <35	>1200 - <35	>50 - <8
Application		**EZVI**	Injection	PRBs		
SSA (m^2/g)		**>0. 90**	0.36	0.32	0.97	0.70
Fe %		**>98**	>98	>98	>95	>95
Reaction Time	**72h**	**10.58**	7.00	2.87	9.68	8.27
	168h	**8.21**	6.53	2.90	6.73	5.26
Active Loss (%)		**22.4**	6.7	0	30.5	36.4

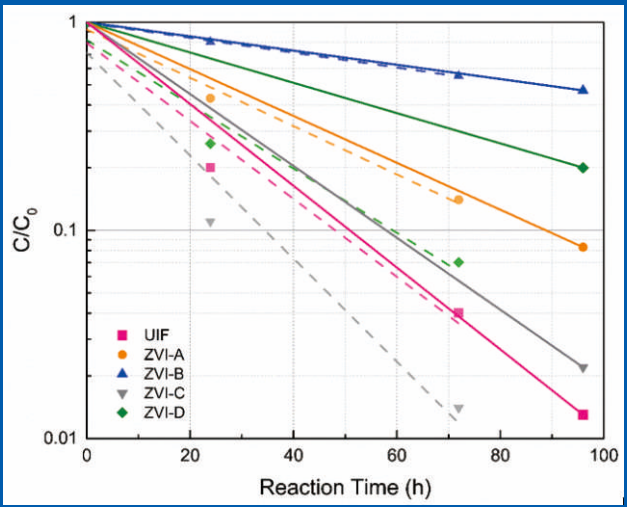


Fig.1 ZVI Reactivity as Change/Decrease in PCE Removal

As Fig. 1 shown, the PCE removal rate (i.e., slopes of lines for PCE removal) for both ZVI-C and ZVI-D in the first 72h (dashed line) and the second 96h following a PCE re-spike (solid lines) were notably slower with both the grey and green lines "flattening" over time. However, reaction rates for the UIF material (i.e., slopes of red line for PCE removal) were essentially the same.

In general, UIF material shows the fastest and sustained rate of PCE removal. while conventional ZVI C and D lost >36% of their reactivity over a short period of time (ca. 200 hours), the UIF material maintained its performance over the same period.

Laboratory Test 2

Relative reactivity was measured as activity attenuation time of a powder when dissolved in diluted hydrochloric acid at room temperature by determination of the evolved volume of hydrogen as a function of time. Thus, the lower the figure the higher reactivity.

*The reactivity tested by the above method is relative chemical reaction activity.
The results obtained under different batches, test environment and test conditions do not have transverse comparison.

Grade	Geometry	Reaction Time (min)
EG-200	Spherical & Porous	13-17
EG-100	Spherical & Porous	15-20
EG-040	Spherical & Porous	18-23
HH	Irregular	20-24
UIF	Spheroidal	25-30
UH	Spheroidal	35-40
HC-1	Irregular	>720
MH270	Irregular	>720