# **Supporting Information for**

# Ultrafast Cr(VI) Removal from Polluted Water by Microwave Synthesized Iron Oxide Submicron Wires

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### **S1. Experimental**

### S1.1 Submicron wire (MWs) synthesis and reduced form r-MWs

In this study, a small amount (1-2 mg) of commercial graphite powder (crystalline, -300 mesh, 99% from Alfa Aesar) was put in a glass vial. Next, 0.1 mL of  $Fe(CO)_5$  (99.5% and 99.9%-Fe from Strem Chemicals) was added in vial to soak the graphite powder. After waiting around 10 min. for complete wetting of powders and partial evaporation of liquid portion, the graphite/Fe(CO)<sub>5</sub> mixture was placed in a microwave oven and heated continuously for 20 s with 1250 W power. The reddish colored iron oxide MWs were obtained spontaneously along with sparks and glowing in glass vial. This product was then subjected to reduction under 5% H<sub>2</sub>/Ar

atmosphere at 600 °C for 2 hours with 5 °C/min heating rate. The reduced product (r-MWs) was collected for further Cr(VI) removal tests.

#### **S1.2.** Characterization

Scanning electron microscopy (SEM) characterization of the as-obtained MWs was performed on a JEOL JSM-7000F instrument. The morphology of the r-MWs was observed by high transmission electron microscopy (TEM) in a FEI TECNAI G2 F20 microscope at a working voltage of 200 kV. The powder X-ray diffraction (XRD) analysis of the samples was carried out with a Bruker AXS D8 Discover diffractometer with GADDS (General Area Detector Diffraction System) operating with a Cu-K  $\alpha$  radiation source filtered with a graphite monochromator (I = 1.541 Å). The X-ray photoelectron spectroscopic (XPS) elemental analysis of the samples was conducted with Kratos XSAM 800 instrument equipped with scanning atomic emission spectroscopy (AES). BET surface area was measured on a Quantachrome Instruments by Autosorb-1 software. Prior to measurement, r-MWs was degassed at 200 °C for 3 h under high vacuum (<0.01 mbar). The magnetic property of the MWs and r-MWs was measured in a commercial magnetometer (Quantum Design PPMS system) at room temperature, which is a Faraday-extraction type magnetometer.

#### **S1.3** Chromium removal procedure

Cr(VI) solutions with different concentrations (200, 400, 600, 800 and 1000 ppb in DI water) were treated with 2.0 g/L MWs to study their removal capacity. For adsorbent concentration study, the potassium dichromate (K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>) solution containing 500 ppb Cr(VI) was treated with different concentrations of MWs (0.5, 1.0, 1.5, 2.0 and 3.0 g/L). Briefly, the mixture was dispersed with ultra-sonication for 5 min at room temperature and mechanical

stirred for 10 min. subsequently. The MWs were separated from the solutions by centrifuging (Corning 6755). Meanwhile, MWs were separated from the solutions by using a permanent magnet and exposed to similar analytical results. The clear solutions were then collected and subjected to colorimetric analysis to determine the remaining chromium concentrations. For colorimetric analysis, the aforementioned clear solutions (5.25 mL) were taken into test tubes; o-phosphoric acid (0.50 mL, 4.5 M) and DPC (0.25 mL, 5 g/L) were then added. After incubation at room temperature for 30 min. for color development, the absorbance of the samples was measured in a UV-Vis spectrophotometer (UV1601, Shimadzu). Peaks with varied intensities were observed in the spectrometer scans at 540 nm wavelength depending on the concentrations of the remaining Cr(VI) in the samples.

## S2. Results



Fig. S1. SEM microstructure of r-MWs showing its network morphology. The dash lines in (a-c) indicate the formed network of r-MWs.



**Fig. S2.** (a) HRTEM of r-MWs, (b&c) enlarged image showing the clear lattice fringe of Fe(110, PDF#06-0696) and Fe<sub>2</sub>O<sub>3</sub>(311, PDF#39-1346).



Fig. S3. Room temperature magnetic hysteresis loops of (a) WMs and (b) r-MWs.



Fig. S4. Magnetic separation of r-MWs after water treatment.



Fig. S5. XPS spectra of (a) MWs and (b) r-MWs.



Fig. S6. Nitrogen adsorption-desorption isotherms of r-MWs.

The pore property of r-MWs is essentially important in this work and therefore the  $N_2$  sorption-desorption isotherms is conducted, Fig. S6. The results indicate that the surface area of r-MWs is only 0.66 m<sup>2</sup>/g with a very low total volume of 0.0068 cm<sup>3</sup>/g.



**Fig. S7.** UV-Vis absorption spectra of the Cr(VI) solution after treatment (a) [r-MWs]=2.0 g/L, (b) [Cr(VI)]=500 ppb. Treating time: 15 min, Temperature: 20 °C.



**Fig. S8.** UV-Vis absorption spectra of the Cr(VI) solution after treatment with 2.0 g/L r-MWs for different times. [Cr(VI)]=1000 ppb, Temperature: 20 °C under sonication mixing.



**Fig. S9.** UV-Vis absorption spectra of the Cr(VI) solution after treatment with 2.0 g/L r-MWs at (a) 20 °C, (b) 30 °C, (c) 40 °C, and (d) 60 °C. [Cr(VI)]=1000 ppb, under mechanical stirring.