Supporting

Information

Iron Oxide Nanowires from Bacteria Biofilm as Efficient Visible-Light Magnetic Photocatalyst

Luoshan Wang,[a§] Tushar Kumeria,[a§] Abel Santos,[a] Peter Forward,[b] Martin F. Lambert,[c] and Dusan Losic*[a]*

[a] *School of Chemical Engineering The University of Adelaide, Adelaide, S.A. 5005, Australia*

[b] *SA Waters, Adelaide, SA 5005, Australia*

[c] *School of Civil, Environmental and Mining Engineering, The University of Adelaide, Adelaide SA 5005, Australia*

[§] These authors contributed equally.

***E-Mails:** dusan.losic@adelaide.edu.au; mlambert@civeng.adelaide.edu.au*

S1. TEM images of Iron oxide nanowires

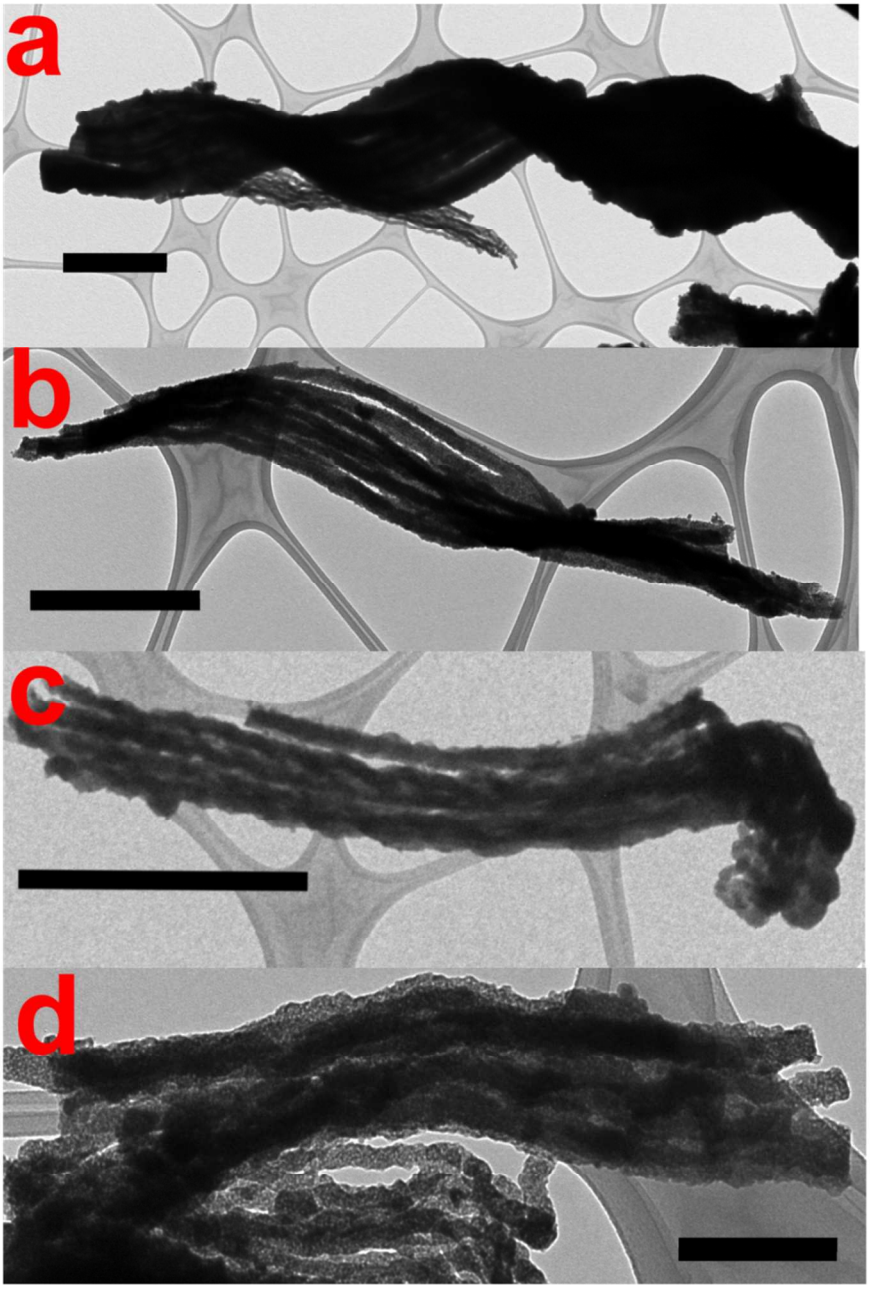

Figure S1. TEM images of Bac-FeOxNWs annealed at different temperatures (a) pristine, (b) 600 °C, (c) 800 °C, and (d) 1000 °C (Scale bar: a-c = 1µm and d = 200 nm).

S2. Raman and EDX Spectroscopy measurements of Iron oxide nanowires

The corresponding Raman spectra of the Bac-FeOxNWs-Pristine and three different temperature annealed samples as displayed in **Figure S2a**. The position of major bands (225.8, 246, 291.9, 409.2, 498.0 and 608.5 cm^{-1}) for 800°C A-Bac-FeOxNWs and 1000°C A-Bac-FeOxNWs particles look identical and are similar to the Raman signature of Hematite α-Fe_2O_3. In addition, the energy dispersive X-ray spectroscopy plot for Bac-FeOxNWs-800 is shown in **Figure S2b** with characteristic peaks assigned to iron and oxygen.

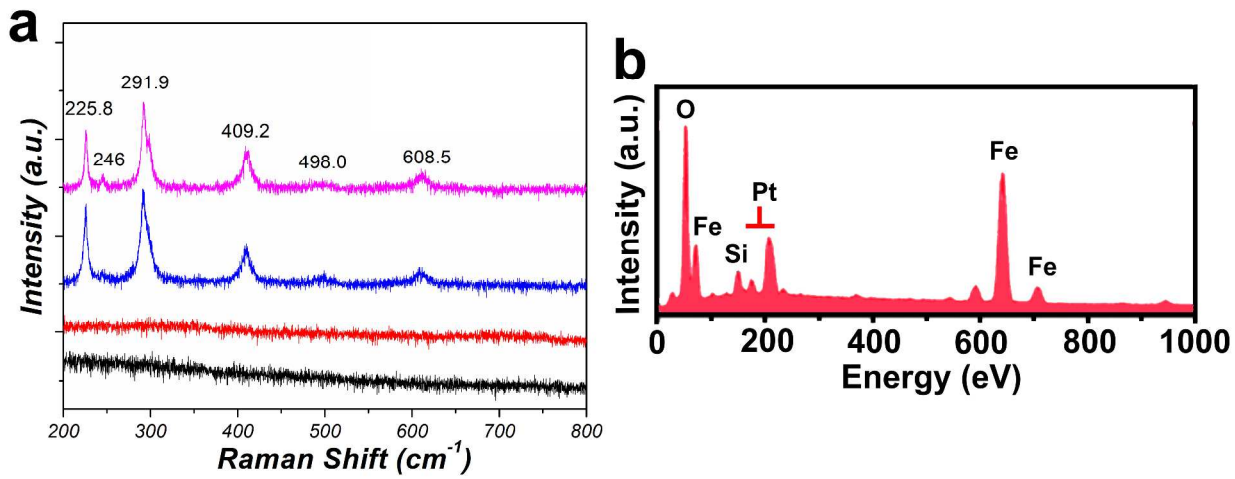

Figure S2. (a) Raman spectrum of nanowires produced by bacteria as biofilm, when annealed at different temperatures (Black line: pristine, red line: Bac-FeOxNWs-600, blue line: Bac-FeOxNWs-800, and pink line: Bac-FeOxNWs-1000). Note, the plots are off-set on Y-axis for clarity, and (b) Energy dispersive X-ray spectroscopy plot for Bac-FeOxNWs.

S3. SQUID measurements

The Bac-FeOxNWs nanowires appear to consist of a mostly hematite in the XRD. The magnetic properties of the nanowires were measured by superconducting quantum interference device (SQUID) magnetometry measurements (**Figure S3**). The sample annealed at 800°C shows nearly single phase magnetic behaviour with a further increase in magnetisation and an extraordinarily large coercivity (> 20 kOe) the magnetic saturation almost 2 emu g^{-1} of Fe. The source of this large coercivity is not known at present but is likely due to exchange anisotropy developed due to strong coupling between the minute quantity of ferrimagnetic magnetite and large quantities of antiferromagnetic hematite present in the analyzed Bac-FeOXNWs samples.[1-2]

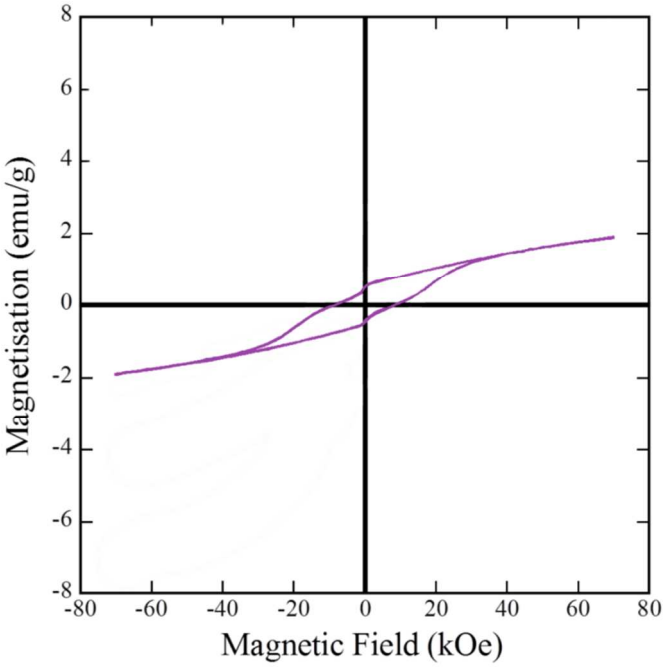

Figure S3. SQUID magnetometry measurements of the Bac-FeOxNWs-800 showing a magnetic hysteresis curve for annealed nanowires.

S4. UV-Vis measurements for RhB degradation

Time dependent UV-Visible traces of Rhodamine B at different concentrations of iron oxide nanowires on visible light irradiation.

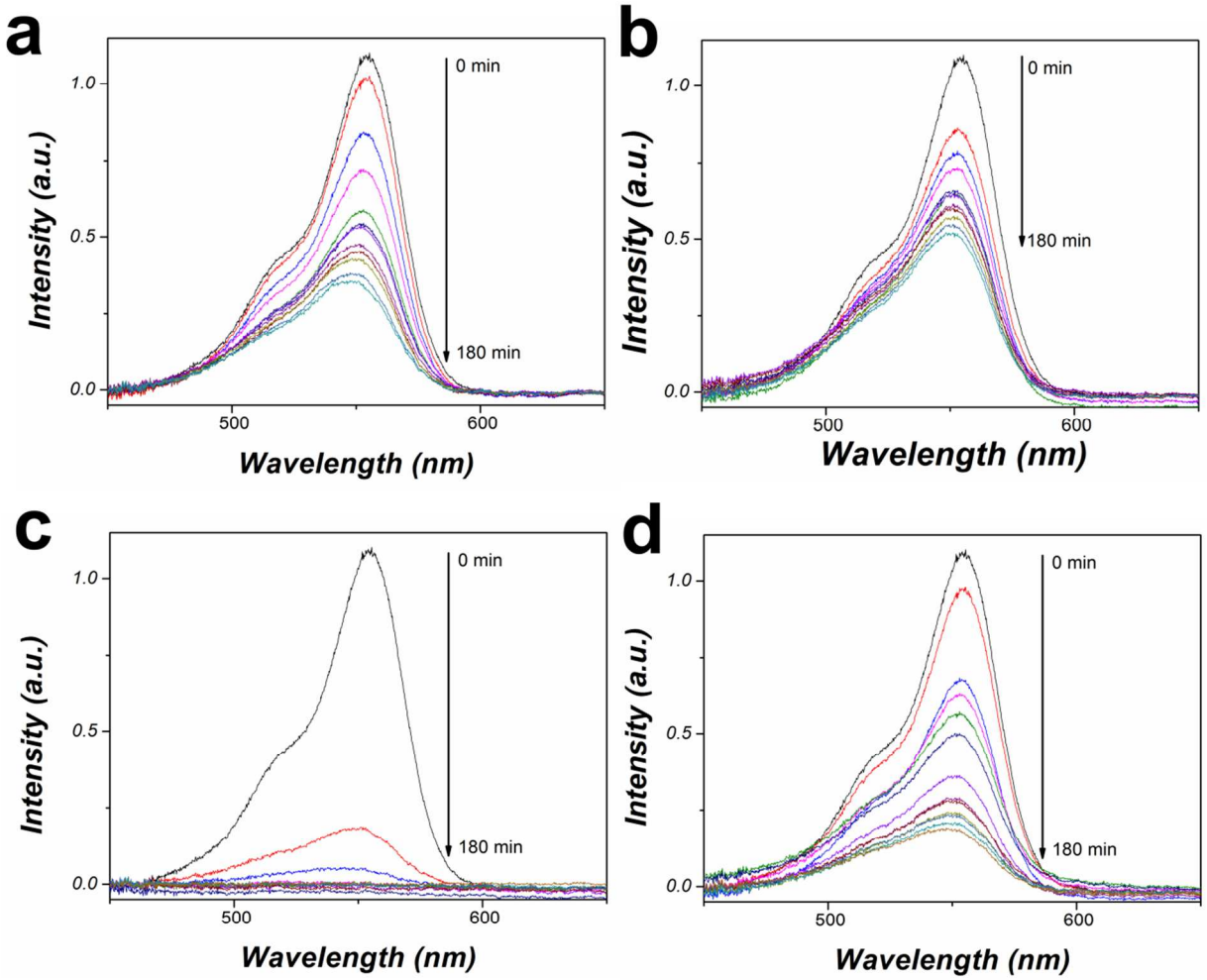

Figure S4. UV-Vis absorption spectrum of time course of degradation of RhB under visible light irradiation in presence of 0.5 mg.mL^{-1} of (a) Pristine nanowires. (b) Bac-FeOxNWs annealed at 600 °C. (c) Bac-FeOxNWs annealed at 800 °C. (d) Bac-FeOxNWs annealed at 1000 °C.

S5. Degradation of RhB with Bac-FeOxNWs under dark

Rhodamine B degradation in presence of Bac-FeOxNWs annealed at different temperatures under dark conditions serves as control for the respective visible light irradiation experiments. The experiment was performed by incubating 0.5 mg/mL of each type of Bac-FeOxNWs with 1.67 x 10^{-5} M RhB. The UV-Vis absorbance measurements revealed no significant decrease in the amount of RhB even after for 3 hr of incubation (**Figure S5**).

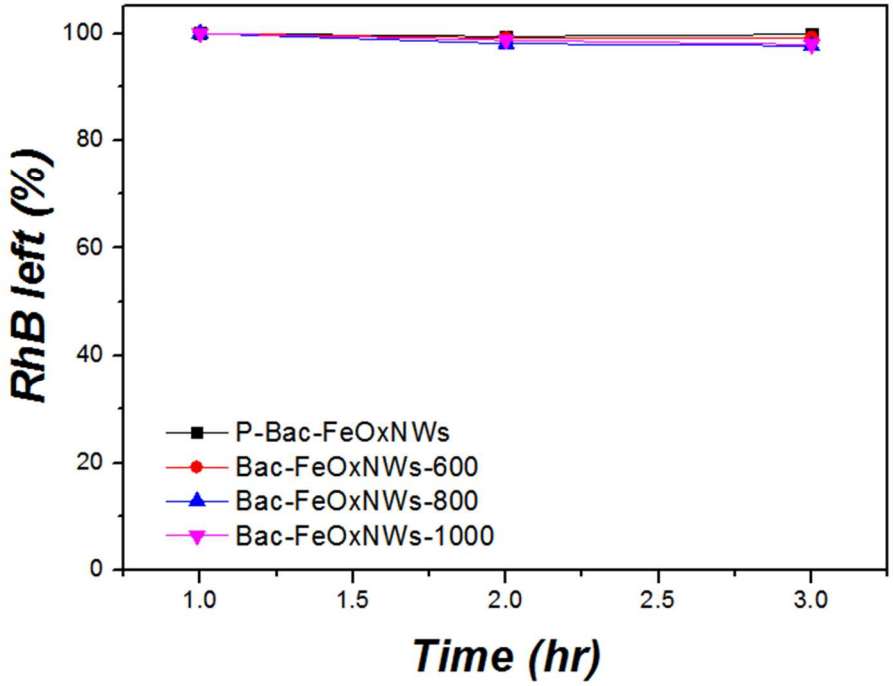

Figure S5. Amount of Rhodamine B (%) left in the degradation mixture after incubation in dark for 3 hr with different Bac-FeOxNWs.

S6. SEM of Bac-FeOxNWs after 6 photocatalysis degradation cycles

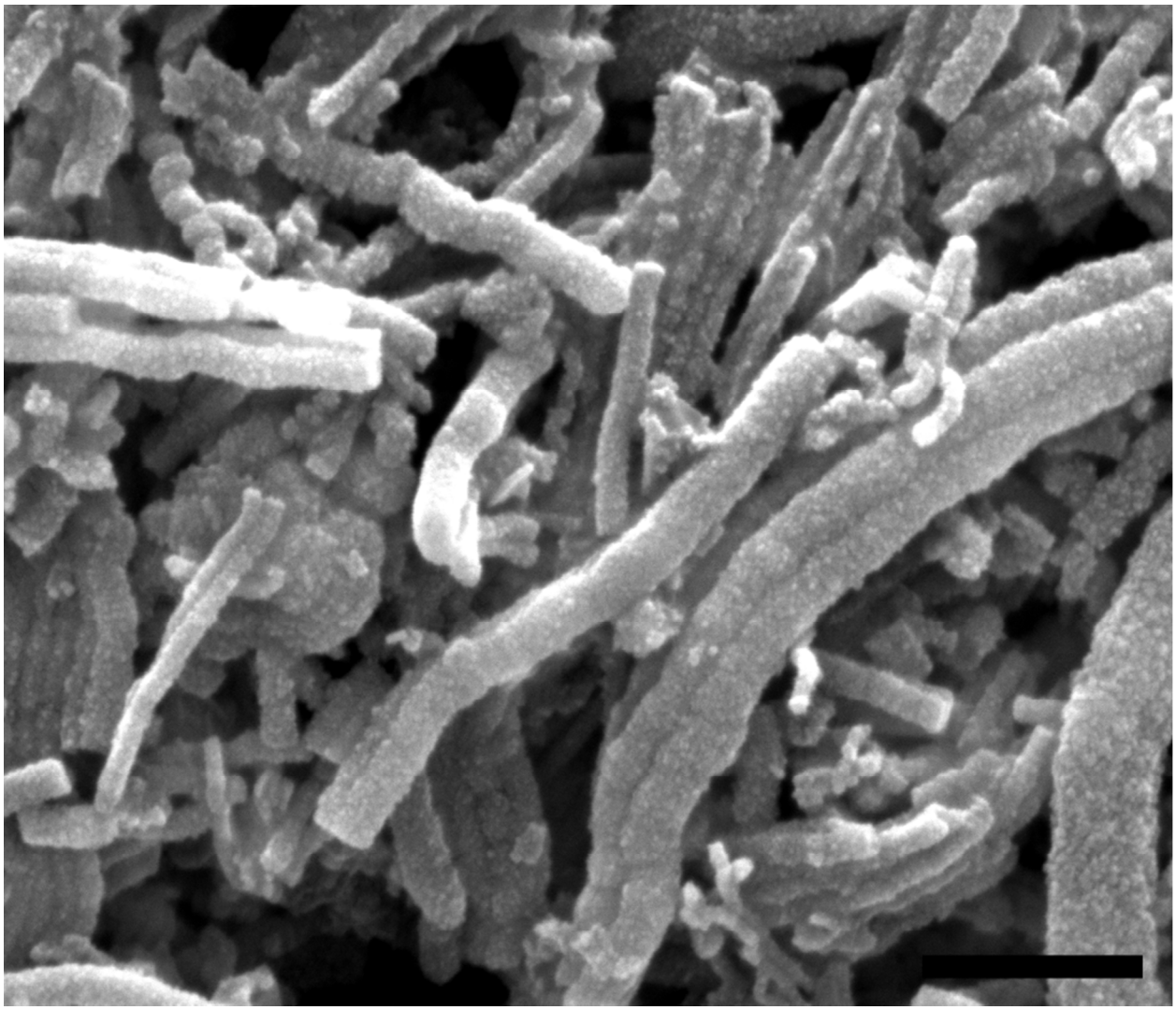

Figure S6. SEM image of bacteria nanowires after using 6 time for degradation of RhB under visible light irradiation (Scale bar: 500 nm).

Video V1: Video provides time digital photographic evidence of the magnetic activity of Bac-FeOxNWs.

1. Meiklejohn, W. H.; Bean, C. P., New magnetic anisotropy. *Physical review* **1956,** *102* (5), 1413.

2. Pankhurst, Q. A.; Connolly, J.; Jones, S.; Dobson, J., Applications of magnetic nanoparticles in biomedicine. *Journal of physics D: Applied physics* **2003,** *36* (13), R167.