Supplementary information

Synthesis of nanostructured chitin-hematite materials under extreme biomimetic conditions

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Materials and methods

Scanning electron microscopy (SEM)

The surface morphology and microstructure of the Fe_2O_3 nanoparticles were examined on the basis of the SEM images recorded on Ultra 55 (Carl Zeiss AG, Germany). Before testing, the samples were coated with carbon over a period of 5 s for 1 min using an Edwards S150B sputter coater.

Raman spectroscopy

The Raman measurements were performed using an LabRam HR 800 spectrometer (from Horiba Jobin Yvon) equipped with a 600 grooves/mm grating and a Peltier cooled CCD detector. The spectra were measured in the backscattering configuration with the laser light focused on the samples and collected through a 100x objective of an Olympus microscope. For excitation the 785 nm line of a diode laser was used. The laser power was chosen in order to avoid the damage to the sample surface during the measurements. The power was set at 1.2 mW for the measurement

of the hematite structures, and 10 mW for the measurements on the chitin/hematite or sponge/hematite systems.

Thermogravimetric analysis

The thermogravimetric analyzer (TG, model Jupiter STA 449F3, Netzsch) was used to investigate the thermal decomposition behavior of the samples. Measurements were carried out under flowing nitrogen (10 cm^3/min) at a heating rate of 10°C/min over a temperature range of 25–1000°C, with an initial sample weight of approximately 5.5 mg.

Results

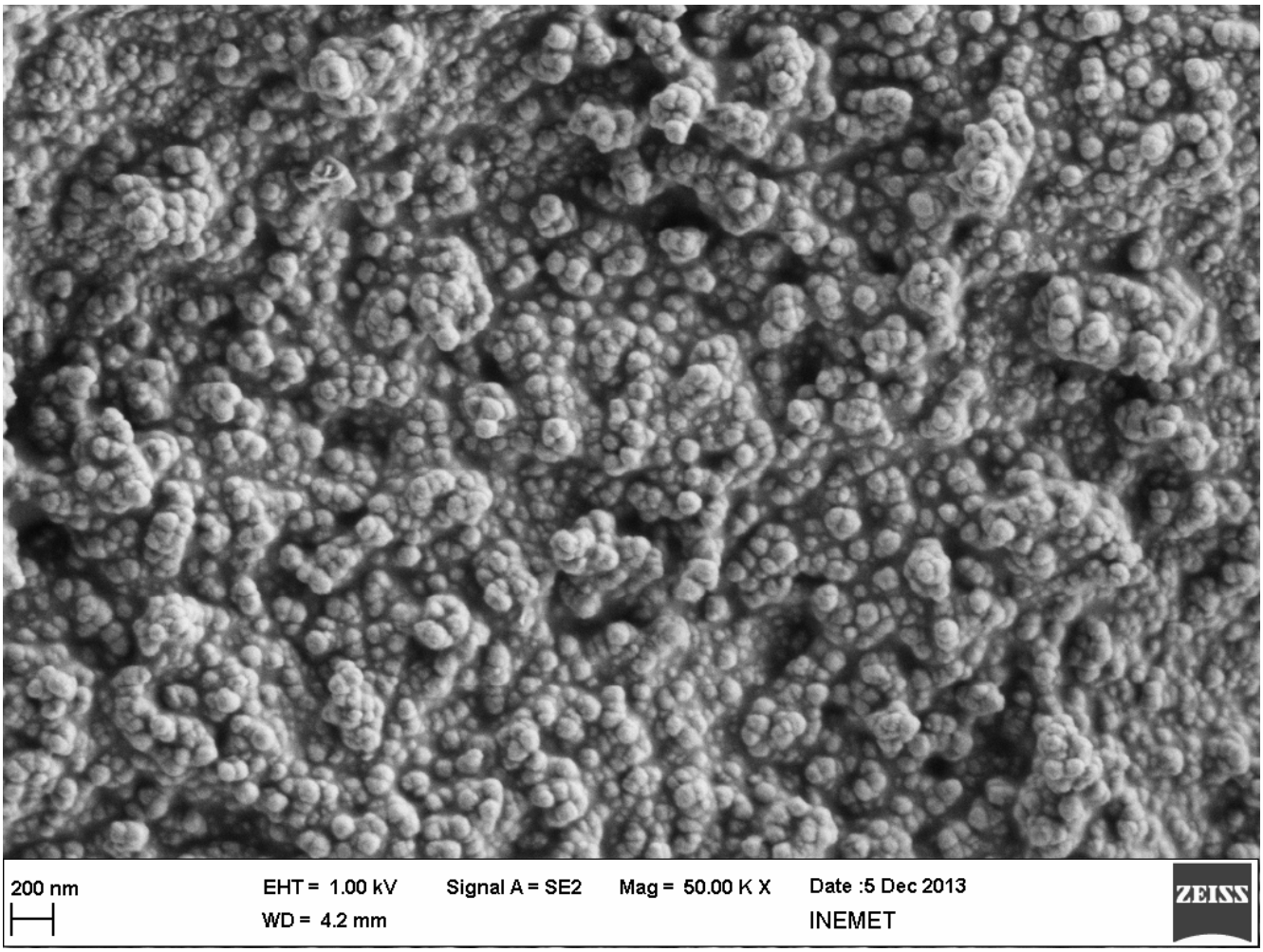

Fig. S1 SEM image of Fe_2O_3 nanoparticles prepared without the chitinous template

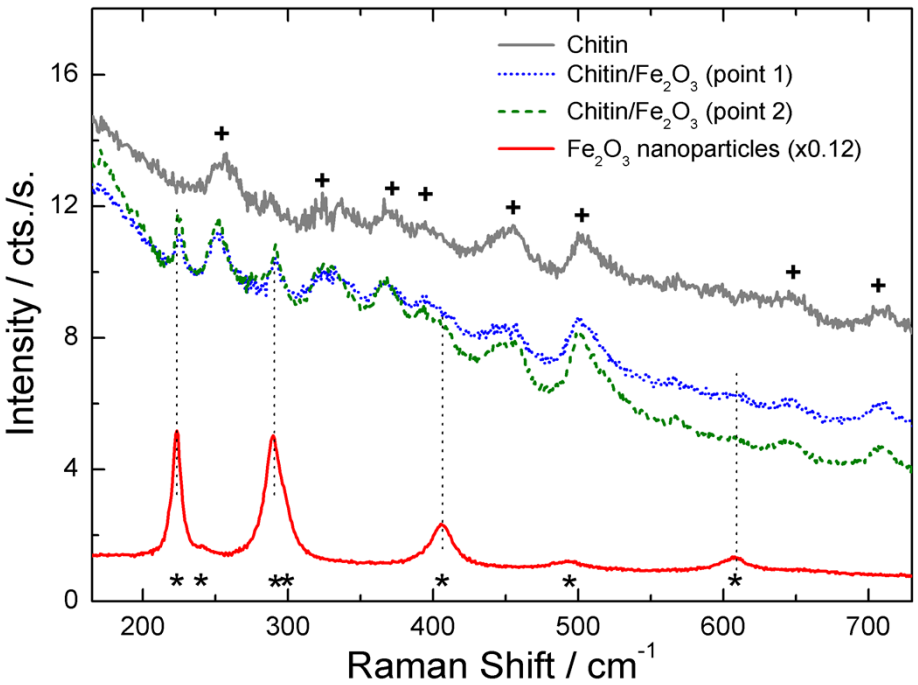

Fig. S2 Raman spectra of *A. aerophoba* sponge α-chitin standard (gray line, characteristic peaks indicated by + symbols), hematite (red line characteristics peaks indicated by * symbols), and chitin-Fe2O3 composite (two typical spectra shown by dotted lines).

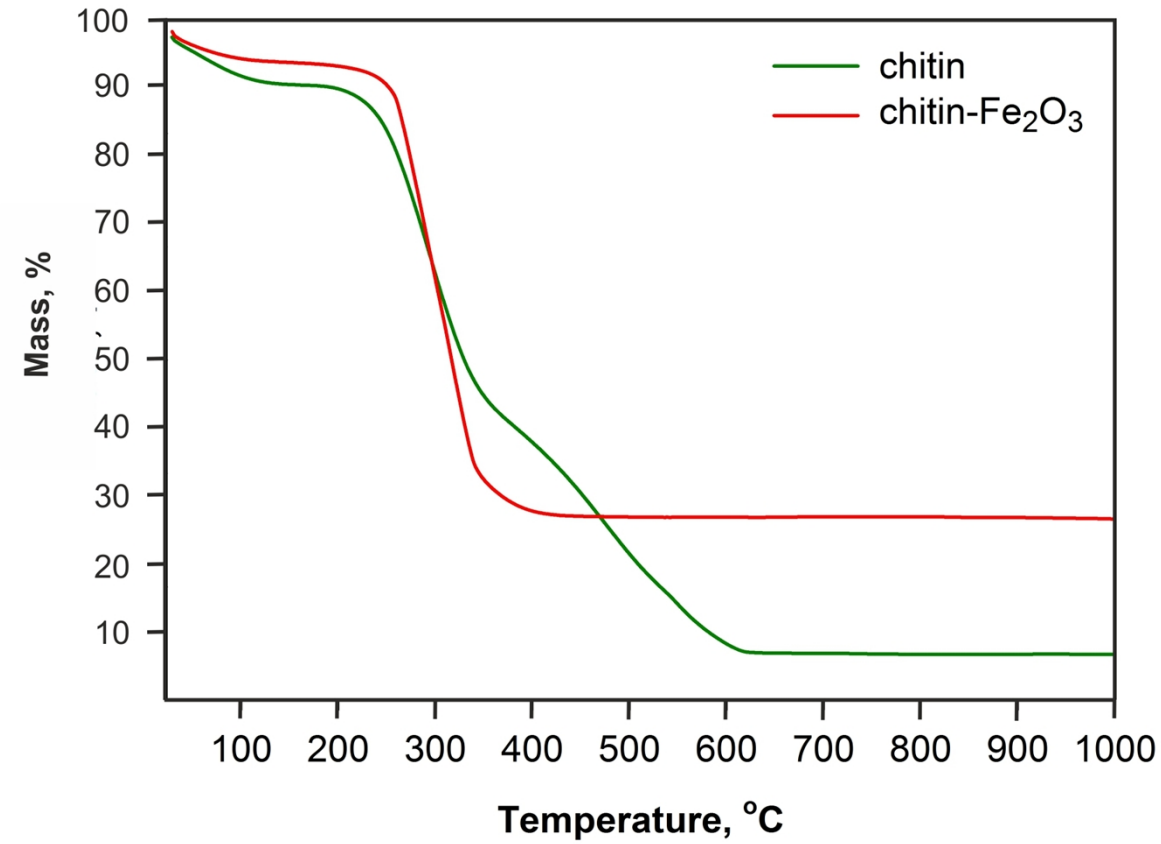

Fig. S3 TG/ DTA curves of α-chitin (green line) and α-chitin-Fe_2O_3 composite (red line)

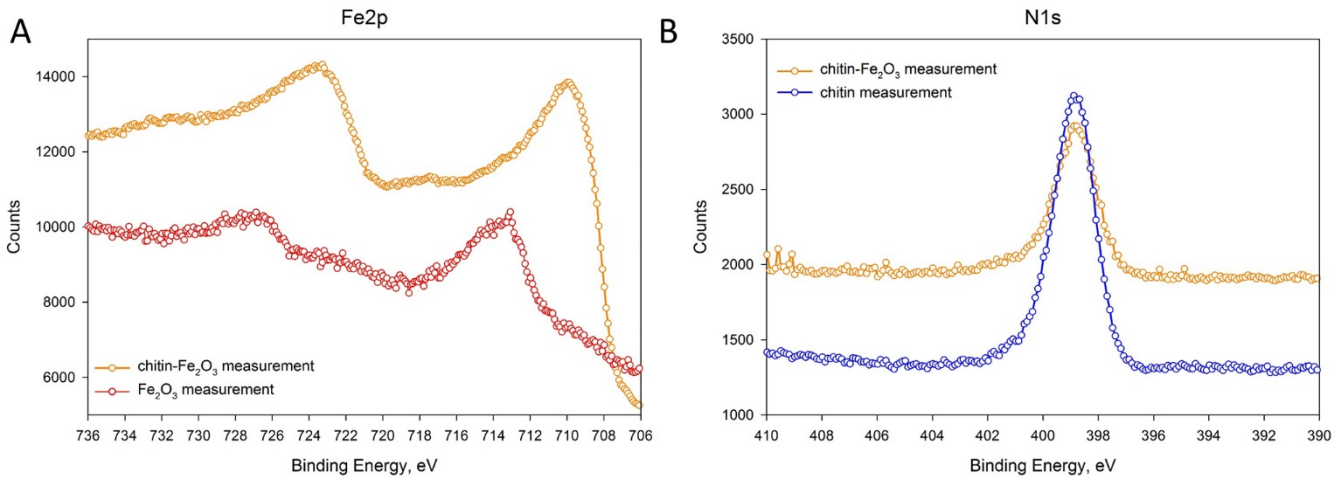

Fig. S4 (A) Fe2p and (B) N1s XPS spectra for *A. aerophoba* sponge α-chitin standard, hematite and chitin-Fe_2O_3.

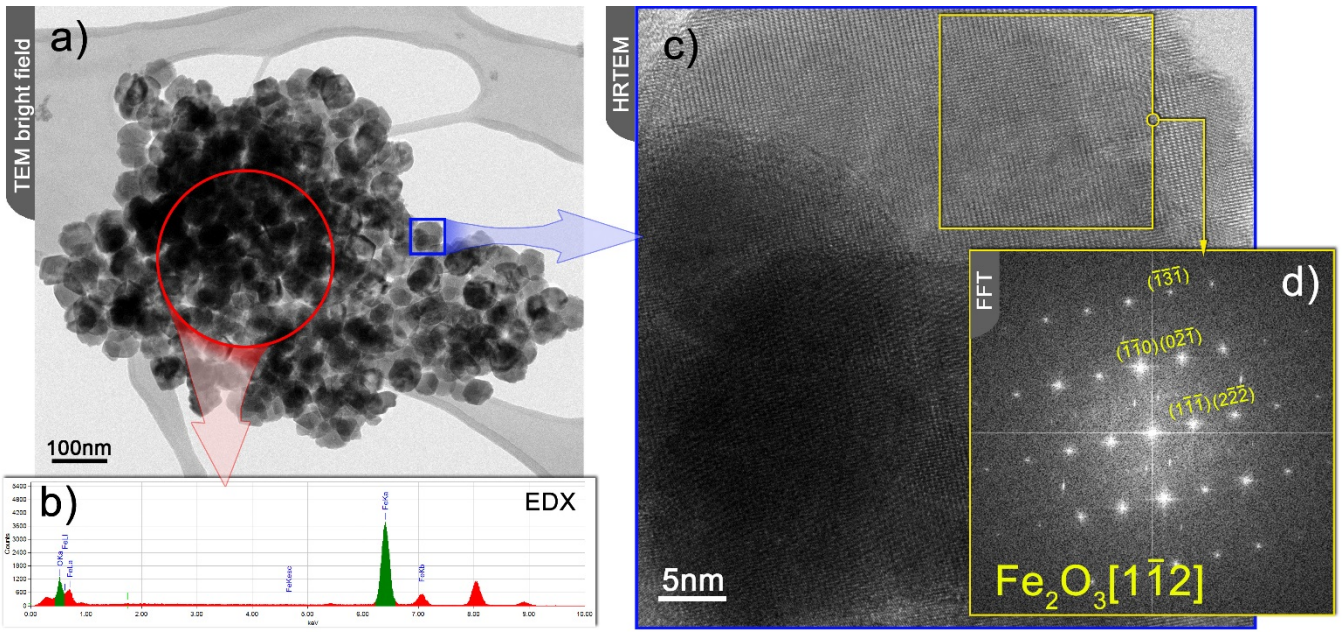

Fig. S5 (a) Bright-field TEM images of Fe_2O_3 prepared without chitinous template and the results of (b) elemental analysis, (c) HRTEM and (d) FFT analysis.

Table S1 Capacitance values of the initial materials and composite

Method	Ch-H(20%) + S30 (80%) (F g^{-1})	S30 (F g^{-1})	Ch-H (F g^{-1})
1 mV s^{-1}	108	97	1.9
10 mV s^{-1}	95	86	0.7
100 mV s^{-1}	74	70	-
100 mA g^{-1}	103	93	-
1000 mA g^{-1}	91	83	-
Imp. at 1 mHz	108	94	-