Carbon-encapsulated iron nanoparticles as a magnetic modifier of bioanode and biocathode in biofuel cell and biobattery

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Supplementary Materials

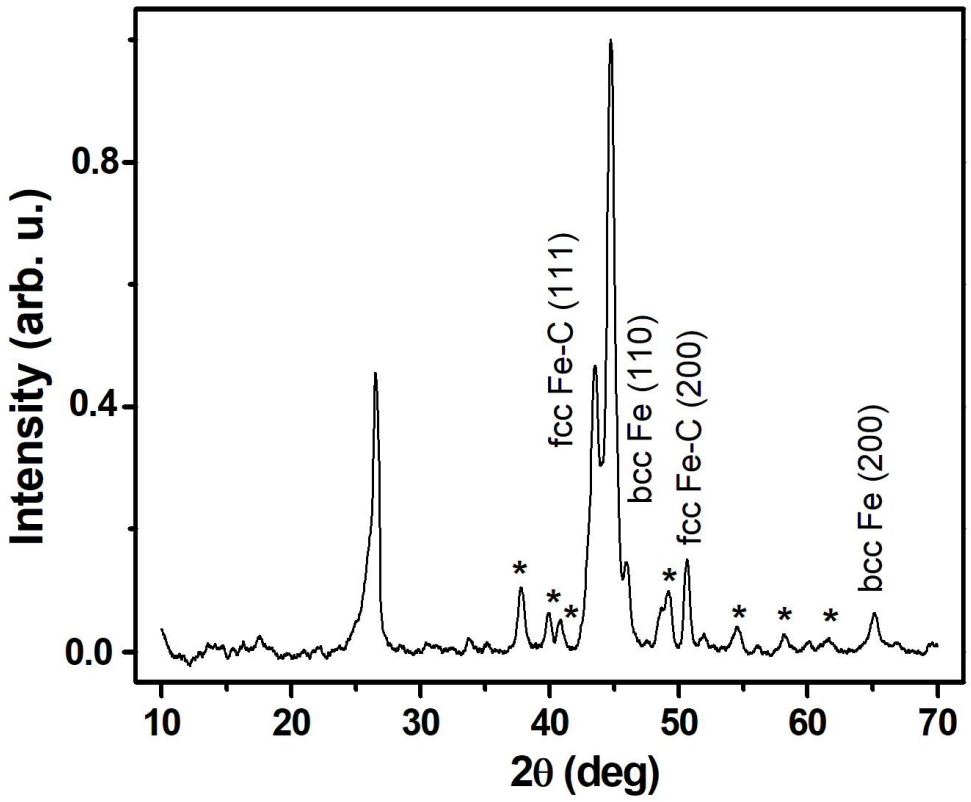

Figure S1. Powder X-ray diffraction pattern of carbon-encapsulated iron nanoparticles.

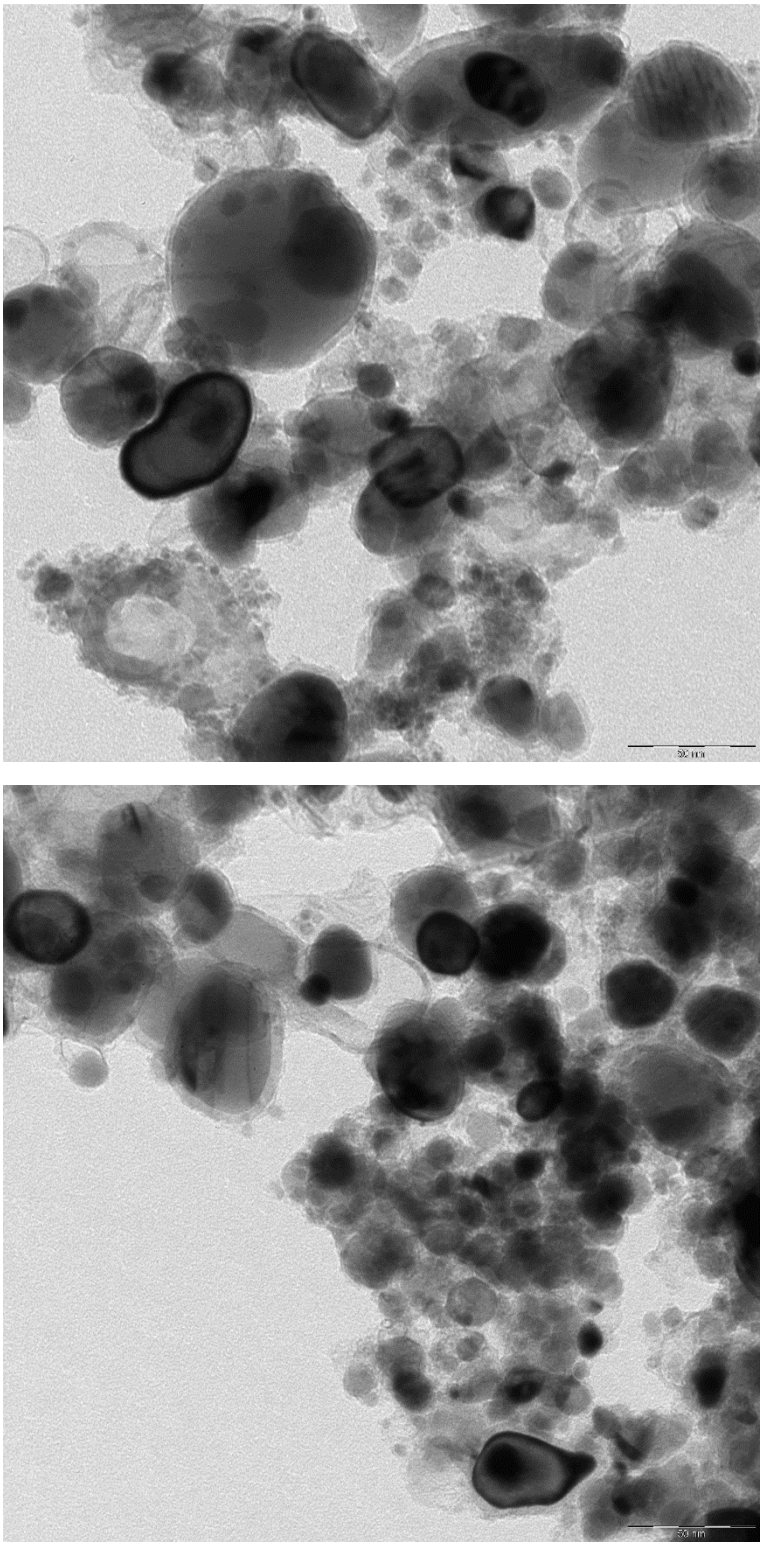

Figure S2. TEM images of carbon-encapsulated iron nanoparticles.

Figure S1 shows the X-ray diffraction pattern of purified carbon-ecnapsulated iron nanoparticles. The material contains four crystalline phases: graphitic phase (the reflection located at ca. 26 deg), bcc Fe, fcc Fe-C and iron carbide (Fe_3C). The reflections arising from iron carbide are marked by an asterisk. Importantly, the position of the (110) and (200) Fe reflections is in perfect agreement with

the reference pattern of pure bcc Fe. The reflections from the fcc Fe-C phase are downshifted in comparison to the reference diffractogram. This phenomenon is related to the occurrence of the carbon, which is present in the vacancies of the fcc Fe lattice.

Figure S2 shows representative TEM images of carbon-encapsulated iron nanoparticles. The materials comprises spherical and spheroidal metallic nanoparticles which are tighly covered by a thin carbon coating. The thickness of the carbon coating does not exceed few nm. The metallic cores have the diamter between 10 and 100 nm.