Supporting Information

Fabrication of Electromagnetic Fe3O4@Polyaniline Nanofibers with High Aspect Ratio

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Characterization

Fourier transform infrared spectra (FTIR) were obtained on a Bruker TENSOR 27 spectrometer. X-ray diffraction patterns (XRD) were got on a Shimadzu XRD-7000S diffractometer with Cu\textsubscript{ka} radiation (\(\lambda=1.548\text{Å}\)) from 20° to 80°. X-ray photoelectron spectra (XPS) were gained through a Kratos Axis Ultra DDL spectroscopy.

Figure 1. Some representative SEM and TEM images of Fe3O4@PANI nanofibers.

Figure 2. FTIR spectra of Fe3O4 microspheres, Fe3O4@PANI nanofibers, and Fe3O4@PANI microspheres.

FTIR spectra of Fe3O4 microspheres, Fe3O4@PANI nanofibers, and Fe3O4@PANI microspheres.
microspheres are shown in figure 2. For Fe$_3$O$_4$ microspheres, the characteristic absorption peaks present at 590 cm$^{-1}$ assigned to Fe-O vibration. For Fe$_3$O$_4$@PANI nanofibers and Fe$_3$O$_4$@PANI microspheres, the characteristic absorption peaks at 1641, 1621, 1412, 1348, 1095, and 810 cm$^{-1}$ are related to C=C stretching vibration of quinoid rings and benzenoid rings, C-N stretching, C=N stretching, C-H bending in plane and out of plane in the 1,4-substituted phenyl ring, respectively. The relatively high intensity of a band at 635 cm$^{-1}$ (Fe-O vibration in Fe$_3$O$_4$) in Fe$_3$O$_4$@PANI nanofibers and Fe$_3$O$_4$@PANI microspheres indicates the PANI coating shell is thin, which demonstrates that the PANI coating shell onto the Fe$_3$O$_4$ microspheres are successfully prepared.

Figure 3 shows the XRD patterns of Fe$_3$O$_4$ microspheres, Fe$_3$O$_4$@PANI nanofibers, and Fe$_3$O$_4$@PANI microspheres. All detected diffraction peaks ((220) (311) (400) (422) (511) (440)) can be indexed as face centered cubic Fe$_3$O$_4$ (JCPDS Card No. 19-629). For the Fe$_3$O$_4$@PANI nanofibers and Fe$_3$O$_4$@PANI microspheres, the main peaks of them are the same as those of pristine Fe$_3$O$_4$ microspheres, which means that the crystal structure of Fe$_3$O$_4$ microspheres is well-maintained even if they experience the coating process in the acidic solution. Besides, a broad diffraction peak is found from 20° to 30°, which are contributed to the amorphous PANI.
To further analyze the Fe₃O₄@PANI nanofibers and Fe₃O₄@PANI microspheres, XPS spectra was employed to understand the composition of their surface. In figure 4, for Fe₃O₄@PANI nanofibers and Fe₃O₄@PANI microspheres, it is clear that the main content of their surface is C, O, N elements. The binding energy of Fe2p is not obvious, which further supports that the Fe₃O₄ microspheres are confined within a shell of PANI coating shell, in accordance with the TEM images.