Supporting Information

Synthesis of electromagnetic functionalized Fe₃O₄ microspheres/polyaniline composites by two-step oxidative polymerization

Chenkui Cui,† Yunchen Du,*,† Tainhao Li,† Xiaoying Zheng,† Xiaohong Wang,‡ Xijiang Han,† Ping Xu*,†

Chemistry Laboratory Center, Department of Chemistry, Harbin Institute of Technology, Harbin 150001, China,

Beijing Institute of Aeronautical Materials, Beijing 100095, China

Figure S1. SEM images of FNP/PANI₅₀ (A) and OO-FMS/PANI₅₀ (B).
Although 1.0 g of Fe$_3$O$_4$ microspheres and 1.0 g of aniline monomer are used for FMS/PANI$_{50}$, one can obtain ca. 1.06 g of products if only Fe$^{3+}$ is used as oxidant, indicating that the yield of PANI is ca. 6 wt%. In other words, only Fe$^{3+}$ is difficult to produce sufficient PANI in weak acidic medium, most of aniline species still exist in the filtrate. After completely removing Fe$^{3+}$ in the filtrate, it becomes colorless, which is quite similar to solution (a). However, UV/vis absorption spectra reveal the essential differences between the two solutions. As shown, solution (a) exhibits extremely strong absorption near 300 nm due to the presence of aniline monomers, while this strong absorption disappears in solution (b) and is replaced by a weak and broad band centered at ~330 nm that can be attributed to the $\pi$-$\pi^*$ transition of the benzenoid ring, confirming the existence of aniline oligomers rather than aniline monomers after being oxidized by Fe$^{3+}$.

**Figure S2.** Photograph (A) and UV/vis absorption spectra (B) of solution (a) and (b). Solution (a) is the mixture of aniline monomer and HCl solution; Solution (b) is the filtrate of FMS/PANI$_{50}$ prepared with only Fe$^{3+}$ oxidation, which has been treated through removal of Fe$^{3+}$ by ammonia and then being acidified to the same pH value with solution (a).
Figure S3. TG curve of FMS/PANI$_{50}$. 
Figure S4. TG curves of FNP/PANI<sub>50</sub>, OO-FMS/PANI<sub>50</sub>, and PM-FMS/PANI.
Figure S5. Fe 2p XPS spectrum of FMS/PANI$_{50}$. 
Figure S6. Real parts (a) and imaginary parts (b) of the complex permittivity, and real parts (c) and imaginary parts (d) of the complex permeability of FMS/PANI_{50}, FNP/PANI_{50}, OO-FMS/PANI_{50}, and PM-FMS/PANI.
The solution containing FMS/PANI\textsubscript{50} is still colorless after immersion for 24h, while that containing PM-FMS/PANI becomes yellow due to the dissolution of Fe\textsubscript{3}O\textsubscript{4} microspheres, indicating that FMS/PANI\textsubscript{50} has better corrosion resistance to acidic environment than PM-FMS/PANI.

\textbf{Figure S7.} SEM image of PM-FMS/PANI (A), and the photograph of FMS/PANI\textsubscript{50} (a) and PM-FMS/PANI (b) immersed in HCl solution of \textit{ca.} 0.2 M for 24 h (0.1g/15mL) (B).