Kinetics of (3-Aminopropyl)triethoxysilane (APTES) Silanization of Superparamagnetic Iron Oxide Nanoparticles

Yue Liu,† Yueying Li,‡ Xue-Mei Li,†* Tao He†*

†Shanghai Advanced Research Institute, Chinese Academy of Sciences, Shanghai, China 201210

‡State Key Laboratory of Metastable Materials Science and Technology, College of Materials Science and Engineering, Yanshan University, Qinhuangdao 066004, China

Email: lixm@sari.ac.cn; het@sari.ac.cn

Kinetics study of APTES silanization

Correspondence should be addressed to Dr. Xue-Mei Li, Email: lixm@sari.ac.cn, tel: +86-21-20350881, fax: +86-21-20325112. Dr. Tao He, Email: het@sari.ac.cn, tel: +86-21-20325162.
Figure S1. IR spectrum of MNP-NH$_2$ with absorption peaks at 580 cm$^{-1}$ (Fe-O), 1060 (Si-O), 1620 cm$^{-1}$ (NH in plane stretching), 2928 cm$^{-1}$ (CH$_2$ asymmetric stretching), and 3420 cm$^{-1}$ (NH$_2$).

Figure S2. Magnetization properties of bare MNP(a) and APTES modified MNP(b)
Figure S3. X-ray diffraction patterns of MNP and MNP-NH$_2$. The peak position at 20 of 35.8 degrees corresponds to the (311) lattice peak of Fe$_3$O$_4$ crystals confirming the composition of the MNP is Fe$_3$O$_4$.

Figure S4. The TGA weight change profile of MNP-NH$_2$ nanoparticles
Figure S5. The kinetics of MNP nanoparticles coated with APTES using water as the solvent as fitted by Lagergren pseudo-first model. No linear relationship was found between the \( \ln(D_e-D_t) \) with reaction time.

Figure S6. The kinetics of MNP nanoparticles silanization with APTES using water as the solvent as fitted by intra-particle diffusion model.
Figure S7. Histogram of magnetic nanoparticles (MNP) based on TEM image analysis.