Highly Controlled Core/Shell Structures: Tunable Conductive Polymer Shells on Gold Nanoparticles and Nanochains

Shuangxi Xing, Li Huey Tan, Miaoxin Yang, Ming Pan, Yunbo Lv, Qinghu Tang,†

Yanhui Yang† and Hongyu Chen*

Division of Chemistry and Biological Chemistry and Division of Chemical and Biomolecular Engineering, Nanyang Technological University, Singapore 637371

Email: hongyuchen@ntu.edu.sg
Figure S1. SEM images of AuNP@PANI immobilized on NH$_2$-coated silicon wafer at low (a) and high magnifications (b).
**Figure S2.** UV-Vis spectra of gold nanochains at 0 hr (black lines) and 12 days (grey lines) after addition of SDS (3.6 mM), for AuNPs samples that has incubated with aniline for 2 hrs (a), 4 hrs (b), 5 hrs (c), 6 hrs (d), 7 hrs (e), 8 hrs (f) and 10 hrs (g). After 12 days, these solutions of Figure 2a barely changed in terms of plasmon absorbance. For sample g (10 hrs incubation), some precipitate was observed after 12 days because of the long chain length.
**Figure S3.** TEM images of isolated AuNP@PANI redispersed in either water (a, c, e, g) or SDS solution (3.6 mM, b, d, f, h), after the 1st, 2nd, 3rd and 4th centrifugation-resuspension cycle, respectively. Scale bars: 200 nm. After the 2nd cycle without SDS, insoluble precipitate has to be ultrasonicated for dispersion in water in order to prepare the TEM samples.
**Figure S4.** TEM images of AuNP@PANI extracted from the reaction mixture during polymerization of aniline, at 0.5 h (a), 1 h (b), 1.5 hrs (c), 2 hrs (d), 4 hrs (e), 7 hrs (f), 12 hrs (g), 24 hrs (h), 36 hrs (i) and 48 hrs (j) after the start of polymerization. Scale bars: 100 nm. Insets show magnified views of typical NPs.
**Figure S5.** TEM images of AuNP@PANI after the 1\(^{st}\), 2\(^{nd}\), 3\(^{rd}\), and 4\(^{th}\) growth cycle, respectively. Scale bars: 100 nm.
**Figure S6.** A typical TEM image of a control experiment that mixed citrate-AuNPs with pre-formed PANI in SDS solution. The AuNPs aggregated and no obvious polymer shell could be identified.
Figure S7. A typical TEM image of 10 nm AuNP@PANI.
Figure S8. A typical TEM image of 60 nm AuNP@PANI.
Figure S9. A typical TEM image of AuNR@PANI.
Figure S10. A typical TEM image of 22 nm AuNP@PPy.
Figure S11. A typical TEM image of PtNP@PPy.
Figure S12. Raman spectrum of AuNP@PPy.