Electronic Supplementary Information

Figure S1 shows UV/Vis absorption spectra of dyes that were desorbed from pure TiO_2 films and mixture films. The amount of desorbed dyes is about 20 % larger in pure TiO_2 films than in mixture films. This difference in the dye adsorption is mainly due to a decrease in the surface area in mixture films.

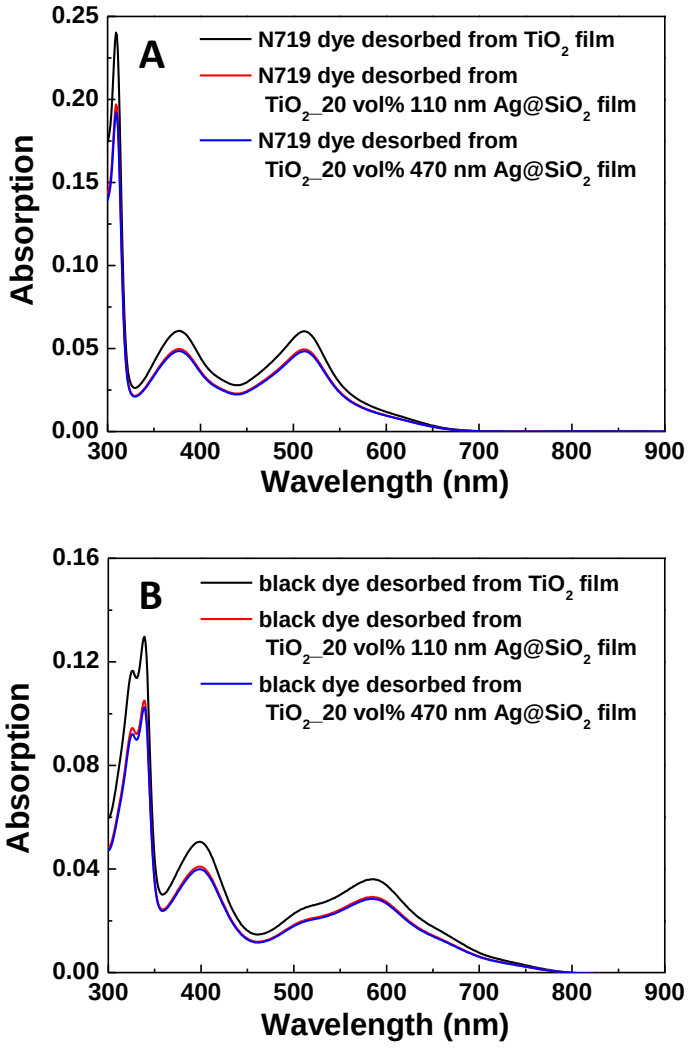

Figure S1. Comparison of UV-vis absorption spectra of desorbed dye from pure TiO_2 film, 20 vol% 110 nm $Ag@SiO_2$ embedded composite film and 20 vol% 470 nm $Ag@SiO_2$ added composite film with (A) N719 dye or (B) black dye.

Figure S2 shows the effect of the dye coating on the corrosion resistance of the core-shell particles. UV/Vis absorbance spectra of the N719 dye or black dye coated TiO_2-core-shell composite films did not show a change after they were immersed in the electrolyte for 1 day. Some increase in the the blue region in the electrolyte-dipped sample is due to a small amount of the residual electrolyte attached to the films.

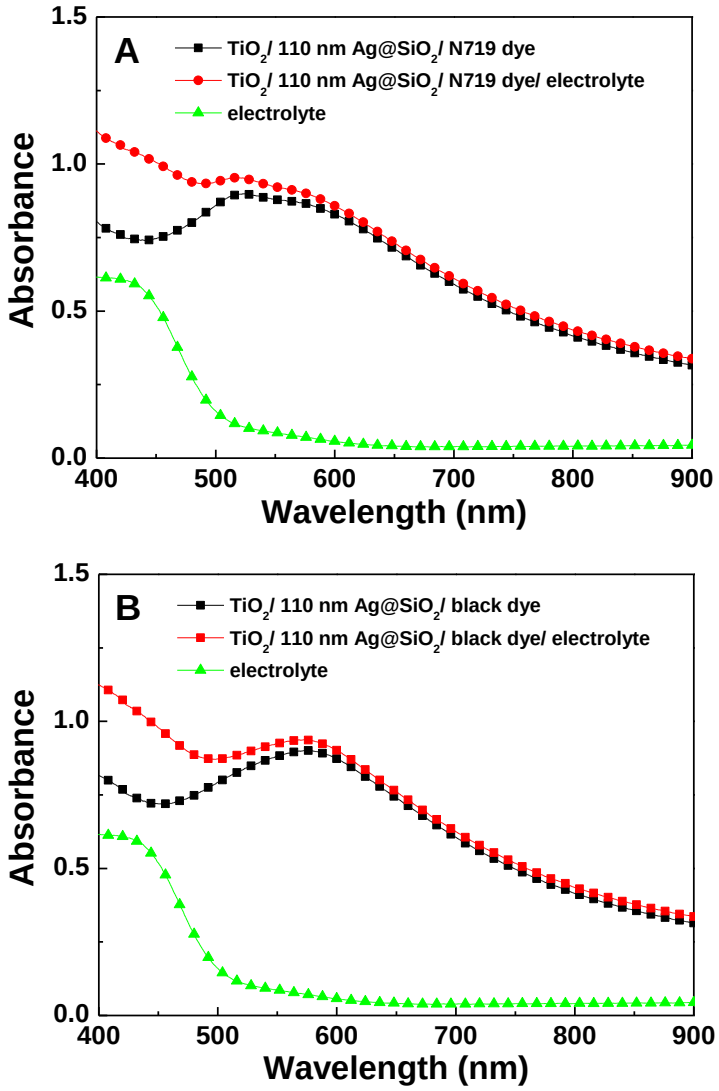

Figure S2. UV/Vis spectra of dye coated photoelectrodes containing 110nm core-shell particles before and after immersed in electrolyte (Iodolyte AN-50) for 1 day; (a) N719 dye and (b) black dye (the spectra of AN-50 electrolyte is shown).

Figure S3 shows the comparison of the *J-V* curve and IPCE of the DSSCs using pure TiO_2 film and TiO_2/SiO_2 composite films. In the composite film, 20 vol % of pure silica core with size of 90 nm or 450 nm was employed. The decreased cell performance reveals that it is the plasmonic Ag nanoshell rather than the large silica core enhanced the cell performance.

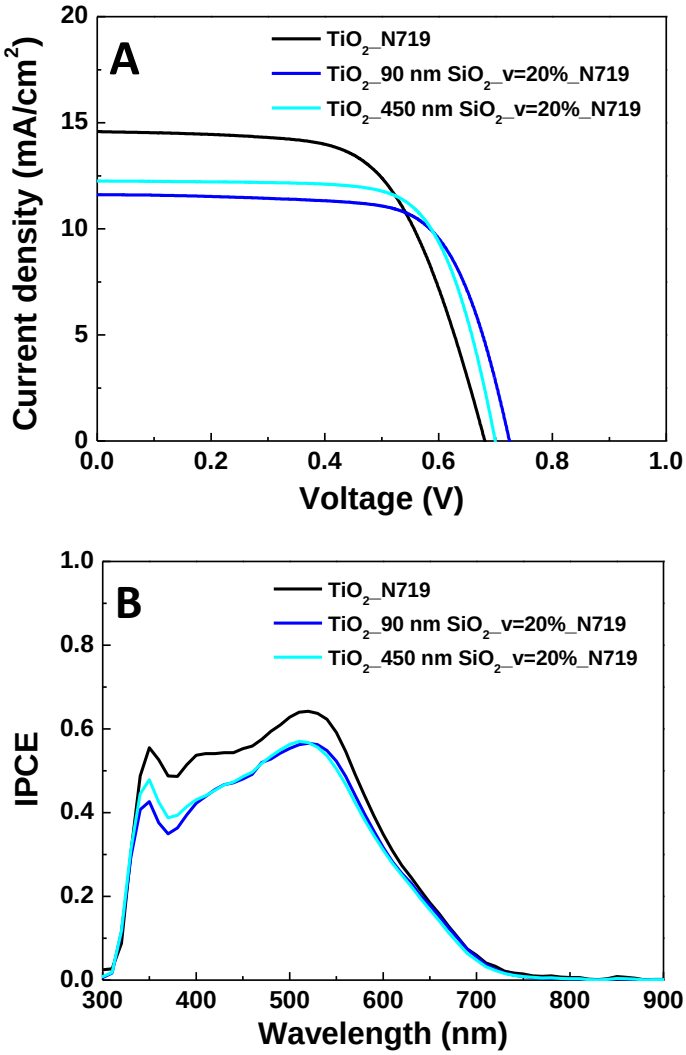

Figure S3. (A) *J-V* curves of N719 dye sensitized solar cells of reference TiO_2 film, 20 vol% 90 nm SiO_2 embedded TiO_2 film, and 20 vol% 450 nm SiO_2 embedded TiO_2 film. (B) IPCE curves of N719 dye sensitized solar cells of TiO_2 film, 20 vol% 90 nm SiO_2 embedded TiO_2 film, and 20 vol% 450 nm SiO_2 embedded TiO_2 film.