Supporting Information

Using Silver Nanowire Antennas to Enhance the Conversion Efficiency of Photoresponsive DNA Nanomotors

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1. Long term stability of azo-DNA nanomotor

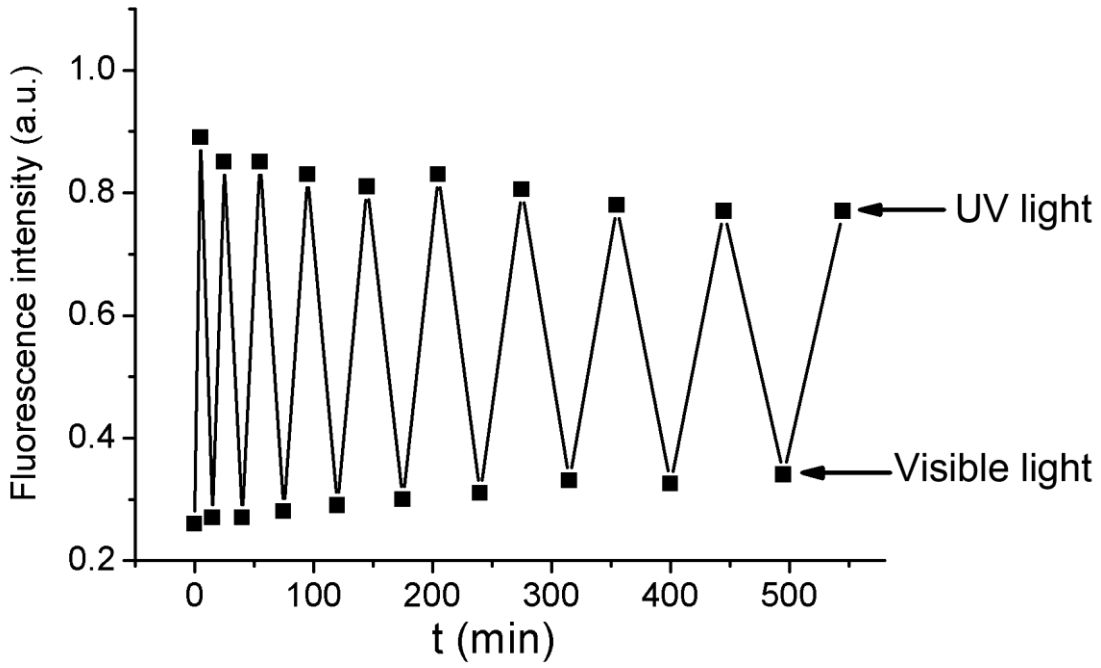

Fig. S1. (A) Cycling of close-open movement under different Vis/UV irradiation time. UV (350 nm), 5 min; Vis (450 nm), 5 min; UV (350 nm), 10 min; Vis (450 nm), 10 min; UV (350 nm), 15 min; Vis (450 nm), 15 min; UV (350 nm), 20 min; Vis (450 nm), 20 min; UV (350 nm), 25 min; Vis (450 nm), 25 min; UV (350 nm), 30 min; Vis (450 nm), 30 min; UV (350 nm), 35 min; Vis (450 nm), 35 min; UV (350 nm), 40 min; Vis (450 nm), 40 min; UV (350 nm), 45 min; Vis (450 nm), 45 min; UV (350 nm), 50 min; Vis (450 nm), 50 min. Fluorescence intensities were recorded immediately after each irradiation.

2. Ag nanowires increase the isomerisation rate of azobenzene from trans- to cis-form.

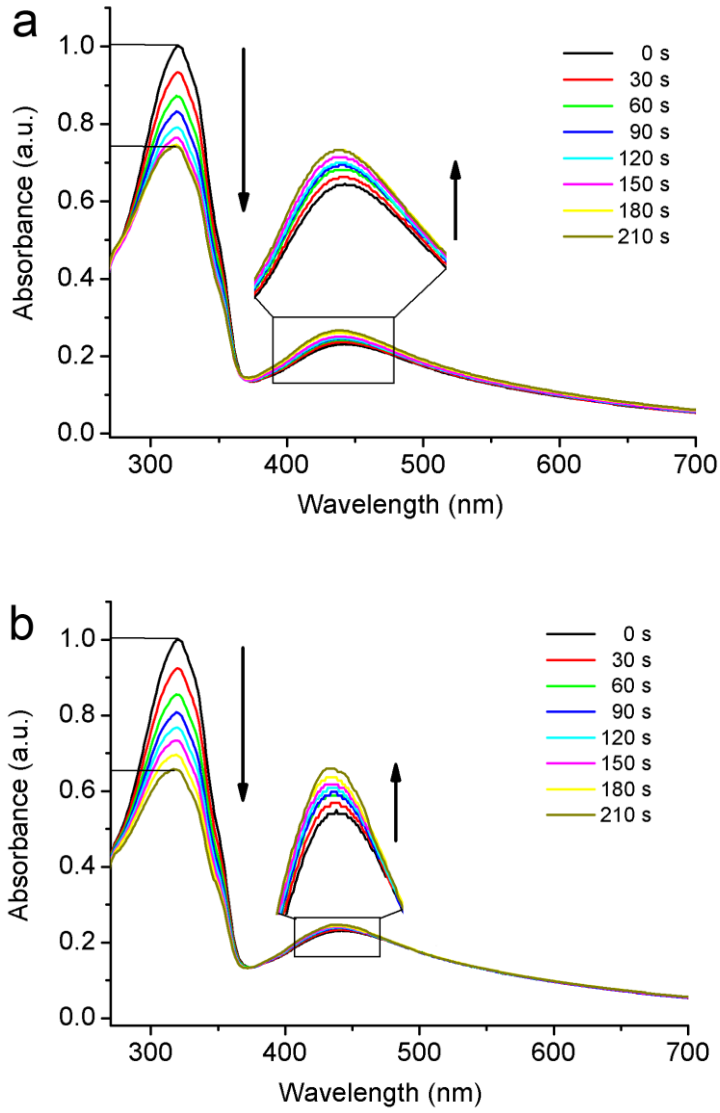

Fig. S2. Absorption spectra of azobenzene under UV irradiation from 0 s to 210 s (a) without and (b) with Ag nanowires.

3. Normal DNA

To verify the increase in conversion efficiency of the DNA motor by Ag nanomaterials through azobenzene moieties, normal DNA (5'FAM-CCT-AGC-TCT-AAA-TCA-CTA-TGG-TCG-C-AGC-ATA-AGG -Dabcyl3') with the same sequence as the DNA nanomotor (5'FAM-CCT-AGC-TCT-AAA-TCA-CTA-TGG-TCG-C-Azo-GC-Azo-TA-Azo-GG -Dabcyl3') was incubated with Ag nanowires. Fluorescence detection of normal DNA, before and after UV illumination, shows that no conversion efficiency increase is achieved. Without azobenzene moieties, the open-close movement of DNA molecules cannot be affected by Ag nanowires.

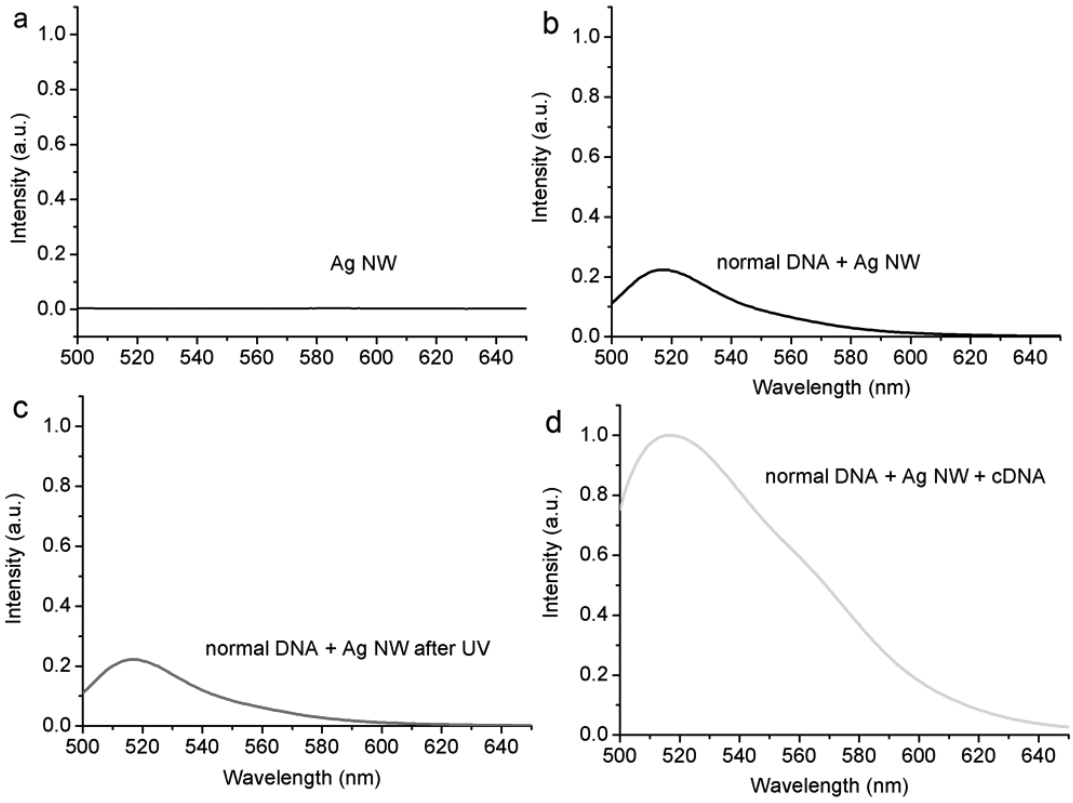

Fig. S3. Fluorescence spectra of (a) Ag nanowires, (b) normal DNA incubated with Ag nanowires, (c) normal DNA incubated with Ag nanowires after 5 min UV irradiation, and (d) normal DNA incubated with Ag nanowires after adding cDNA. Buffer: 8 mM Tris buffer pH 8.0, Na^{+} : 8 mM, Mg^{2+} : 0.8 mM, [DNA] = 5 μM, [cDNA] = 20 μM.

4. Ag nanowires can slightly decrease fluorescence intensity of FAM located at one end of the DNA nanomotor.

In our experiment, the concentration of Ag nanowires is 2 nm. To measure the signal difference of FAM located at one end of the DNA nanomotor, with and without Ag nanomaterials, a comparison of the fluorescence intensity of FAM was carried out. A series of Ag nanowire concentrations was measured, and then an average fluorescence intensity of FAM was calculated. The results show that the fluorescence intensity of FAM was reduced by adding Ag nanowires. With the increase of Ag nanowire concentration (from 0 to 6 nM), fluorescence intensity of FAM decreased gradually to 60% of its original intensity. This result proves that Ag nanostructures cannot directly increase the fluorescence intensity of FAM.

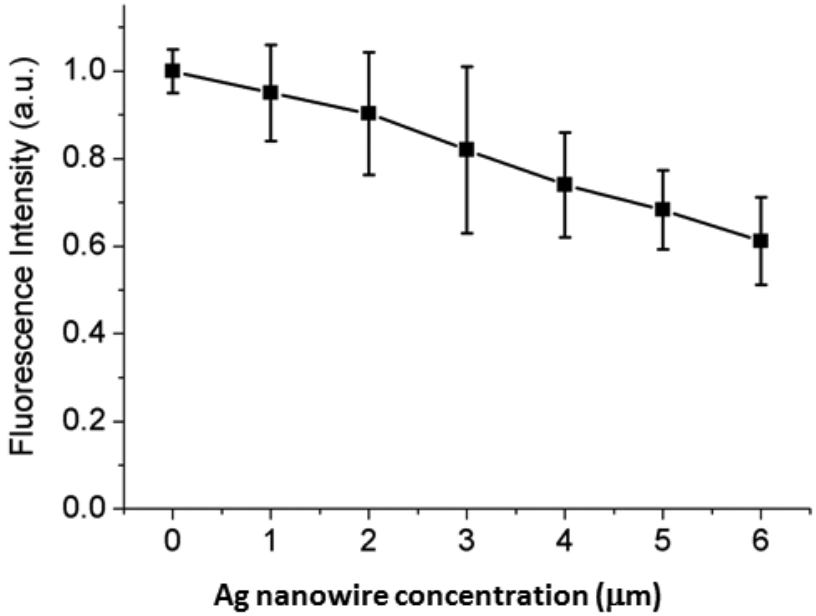

Fig. S4. Fluorescence intensity of DNA nanomotors after incubation with Ag nanowires of different concentrations (without UV light).

5. Ag nanostructures with different morphologies enhance the conversion efficiency of DNA nanomotors.

As shown in Fig. S3 below, fluorescence intensity increase of DNA nanomotors is achieved by incubation with Ag nanostructures having different morphologies. These results indicate that close-open conversion efficiencies of the DNA nanomotor are different after incubated with different Ag nanostructures.

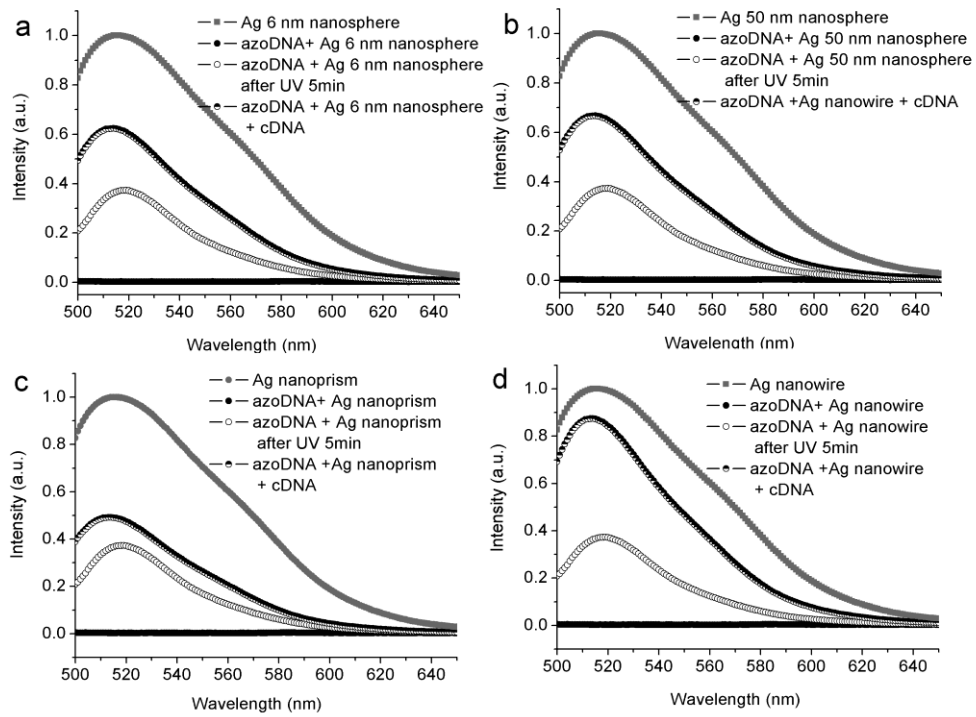

Fig. S5. Fluorescence spectra of DNA nanomotor (λ_{ex} = 488 nm) incubated with (a) Ag nanospheres (6 nm); (b) Ag nanospheres (50 nm); (c) Ag nanoprisms (side length of 50 nm); (d) Ag nanowires (40 μm) under a 6 W UV lamp (350 nm) and a 60 W desktop lamp with 450 nm filter at 25 °C. All other conditions are the same. The blue curve is pure DNA in buffer solution (5 μM); green curve indicates cDNA; and red curve indicates UV/vis irradiation. Buffer: 8 mM Tris buffer pH 8.0, Na^+ : 8 mM, Mg^{2+} : 0.8 mM, [DNA] = 5 μM, [cDNA] = 20 μM.

6. Fluorescence spectra of Au nanostructures with different morphologies

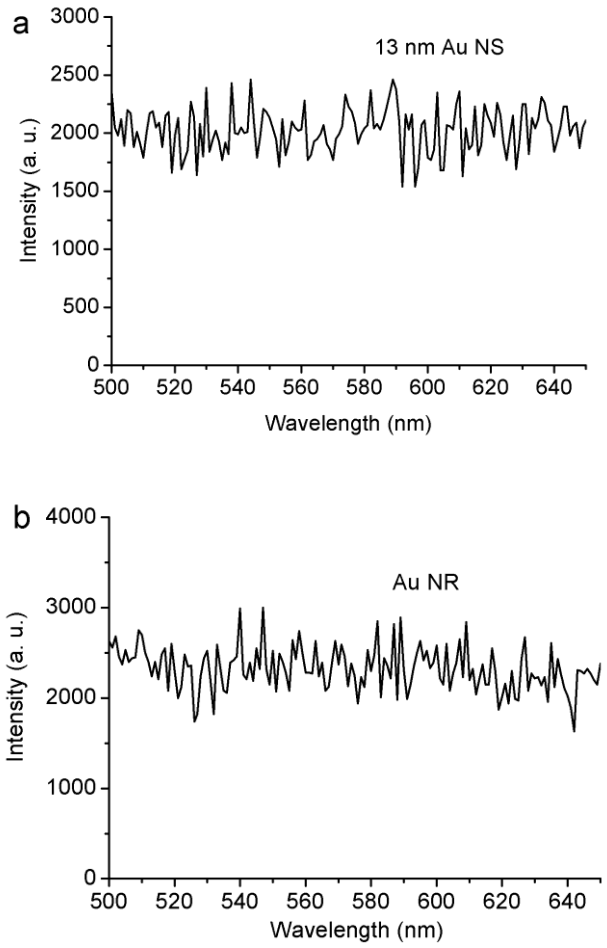

Fig. S6. Fluorescence spectra of Au nanoparticles with different morphologies. (a) 13 nm Au nanospheres; (b) Au nanorods with average length of 60 ± 7 nm and width of 13 ± 3 nm.