Supporting Information:

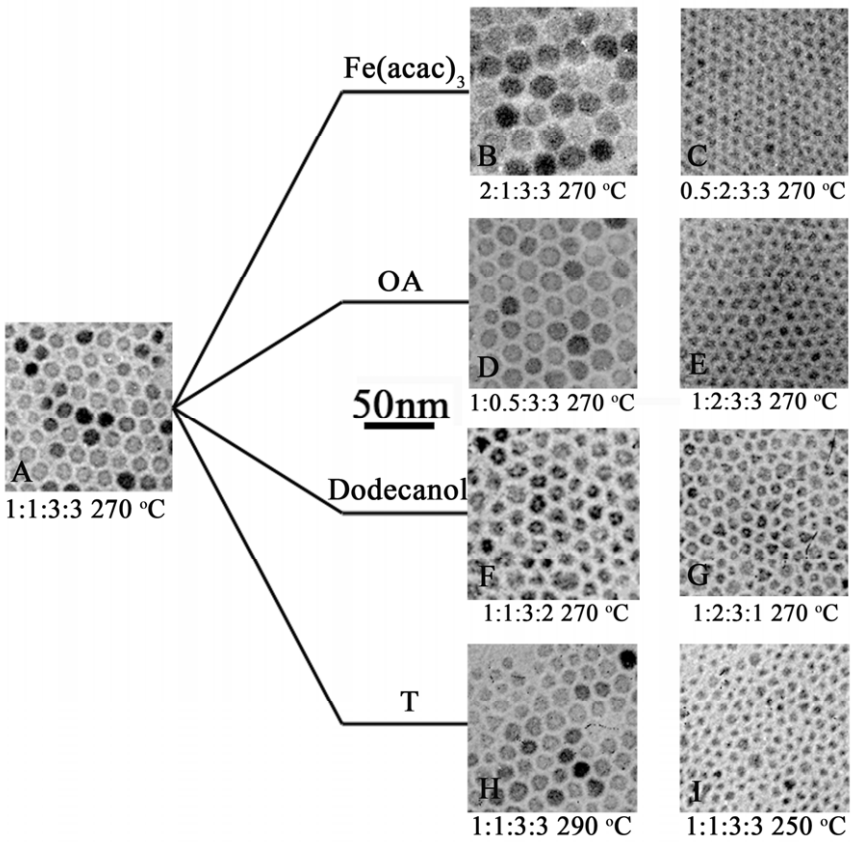

Figure S1. TEM images of Fe_3O_4 NCs synthesized at the same time under different reaction conditions. The ratios show in the under each images was $Fe(acac)_3$: OA : OAm : dodecanol.

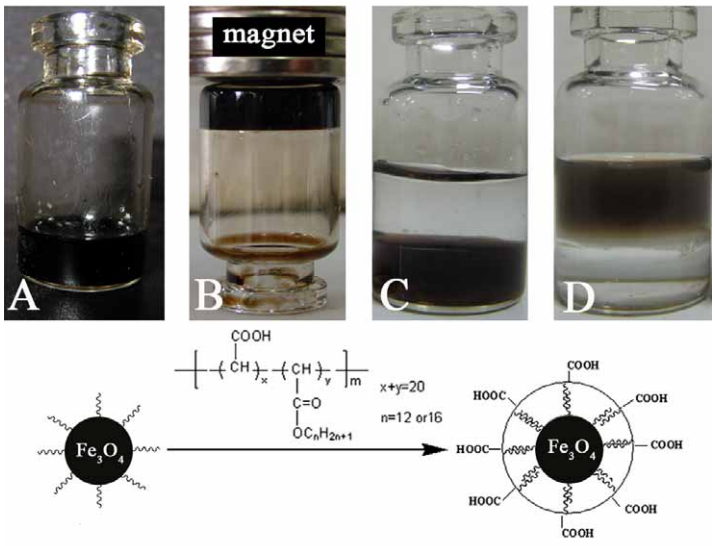

Figure S2. Photographs of Fe_3O_4 NCs solution (A) and in response to external magnetic field (B); Photographs of Fe_3O_4 NCs in chloroform (C) and water (D). The bottom scheme shows the formation of water-soluble Fe_3O_4 NCs by amphiphilic oligomer.

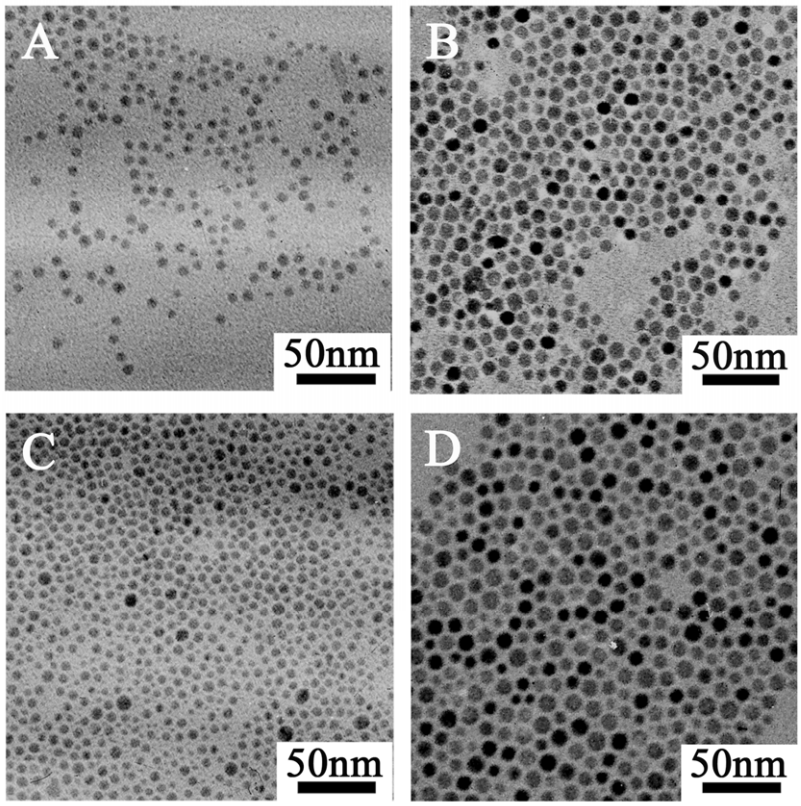

Figure S3. TEM images of Ag NCs synthesized by using Ag(acac) at 110 ^{o}C (A, C) and 200 ^{o}C (B, D) with different reaction times. (30 min for A and B; 5 h for C and D)

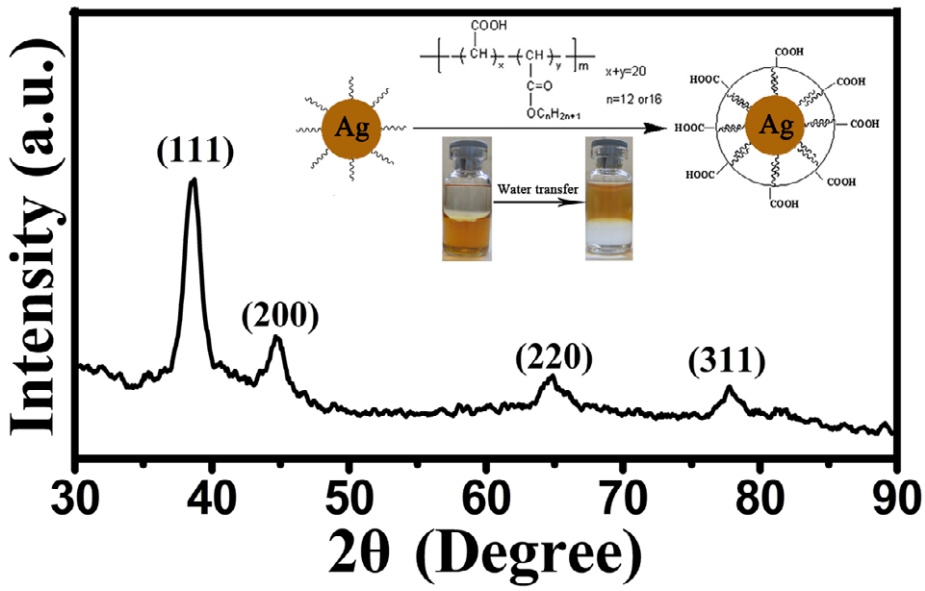

Figure S4. X-ray diffraction patterns of 9 nm Ag NCs. The inset shows photographs of Ag NCs before and after phase transfer and the scheme of the formation of water-soluble Ag NCs by amphiphilic oligomer.

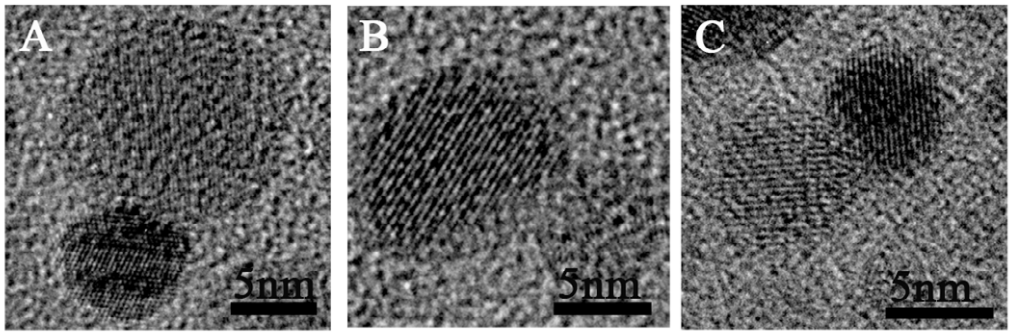

Figure S5. High-resolution TEM images of 16 nm Fe_3O_4- 8 nm Ag (A), 12 nm Fe_3O_4- 6 nm Ag (B), and 5 nm Fe_3O_4- 4 nm Ag (C) heterodimer NCs.

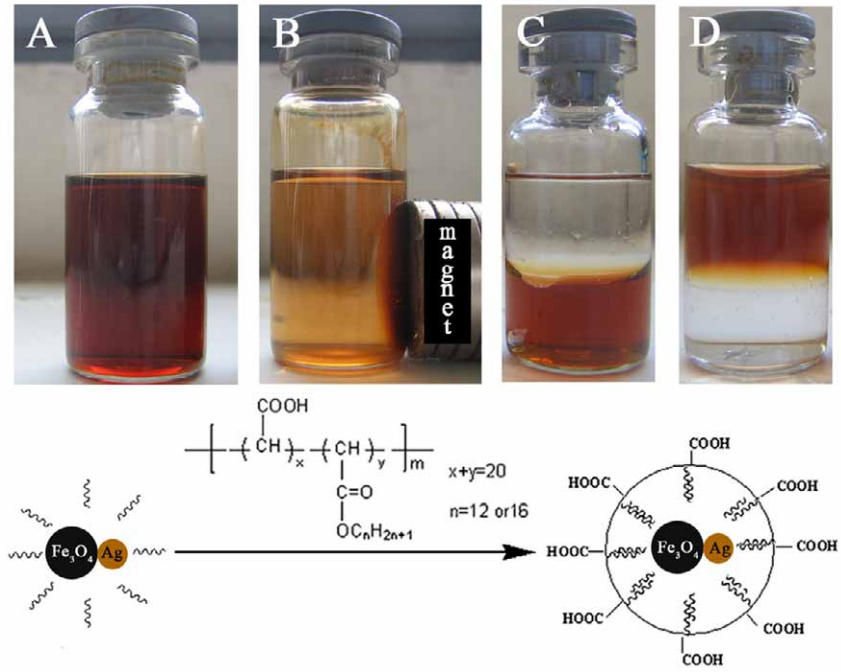

Figure S6. Photographs of Fe_3O_4-Ag NCs solution (A) and in response to external magnetic field (B); C and D are photographs of Fe_3O_4-Ag NCs in chloroform (C) and water (D), respectively. The bottom scheme shows the formation of water-soluble Fe_3O_4-Ag NCs by amphiphilic oligomer.