Supporting Information

Thermal stability and morphological transformations of Au_{core}-Co_{shell} nanocrucibles

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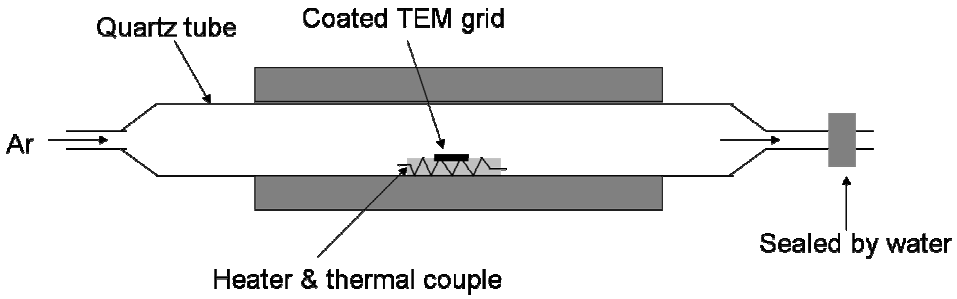

Scheme S1: Furnace for *ex-situ* heating experiment of Au_{core}-Co_{shell} nanoparticles

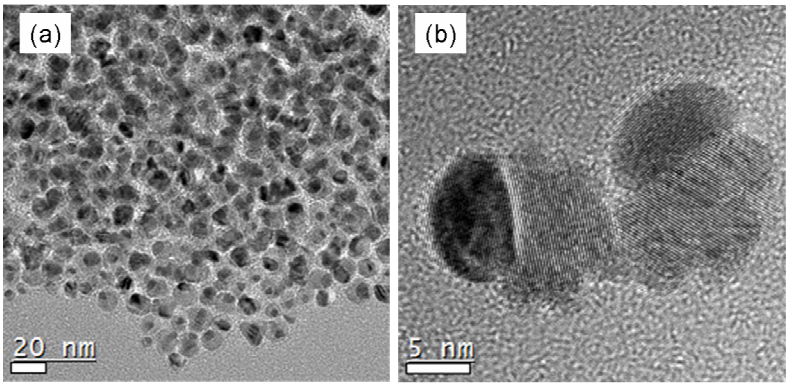

Figure S1. Bright field TEM image of the coalesced Au_{core}-Co_{shell} nanoparticles at the dense area in (a) and HRTEM of two coalesced Au_{core}-Co_{shell} nanoparticles in (b) after heating at 400^{o}C for 10 hours. The interparticle coalescence is not considered in this manuscript.

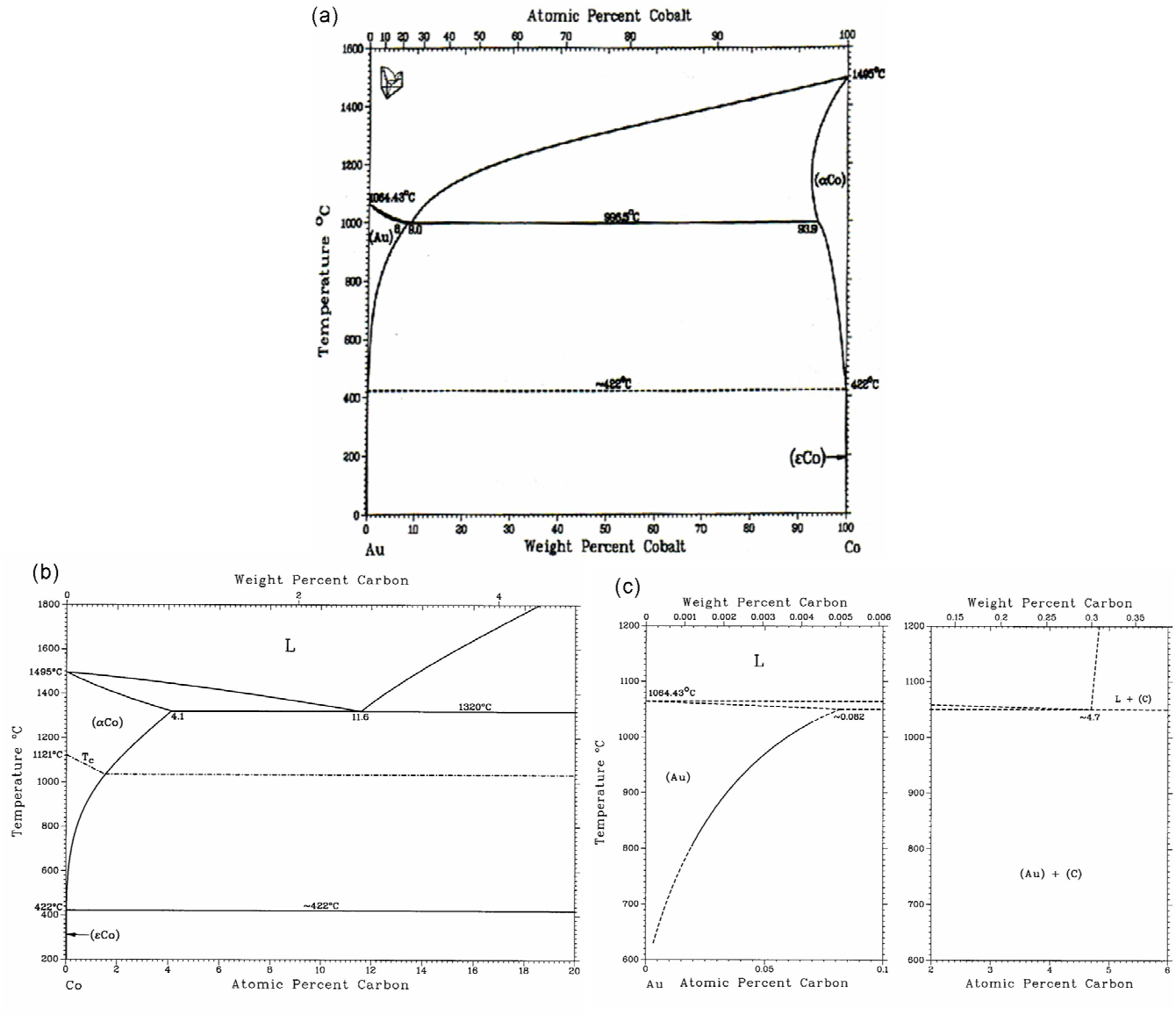

Figure S2 Binary phase diagram of Au-Co system in (a), Co-C system in (b) and Au-C system (magnified for low percentage) in (c). The three elements are mutually immiscible below 500°C with solubility ~ppm [reference: T. B. Massalki, in *Binary Alloy Phase Diagrams*, 2nd ed., edited by T. B. Massalski, H. Okamoto, P. R. Subramanian, and L. Kacprak , ASM International, Metals Park, OH, **1990**]

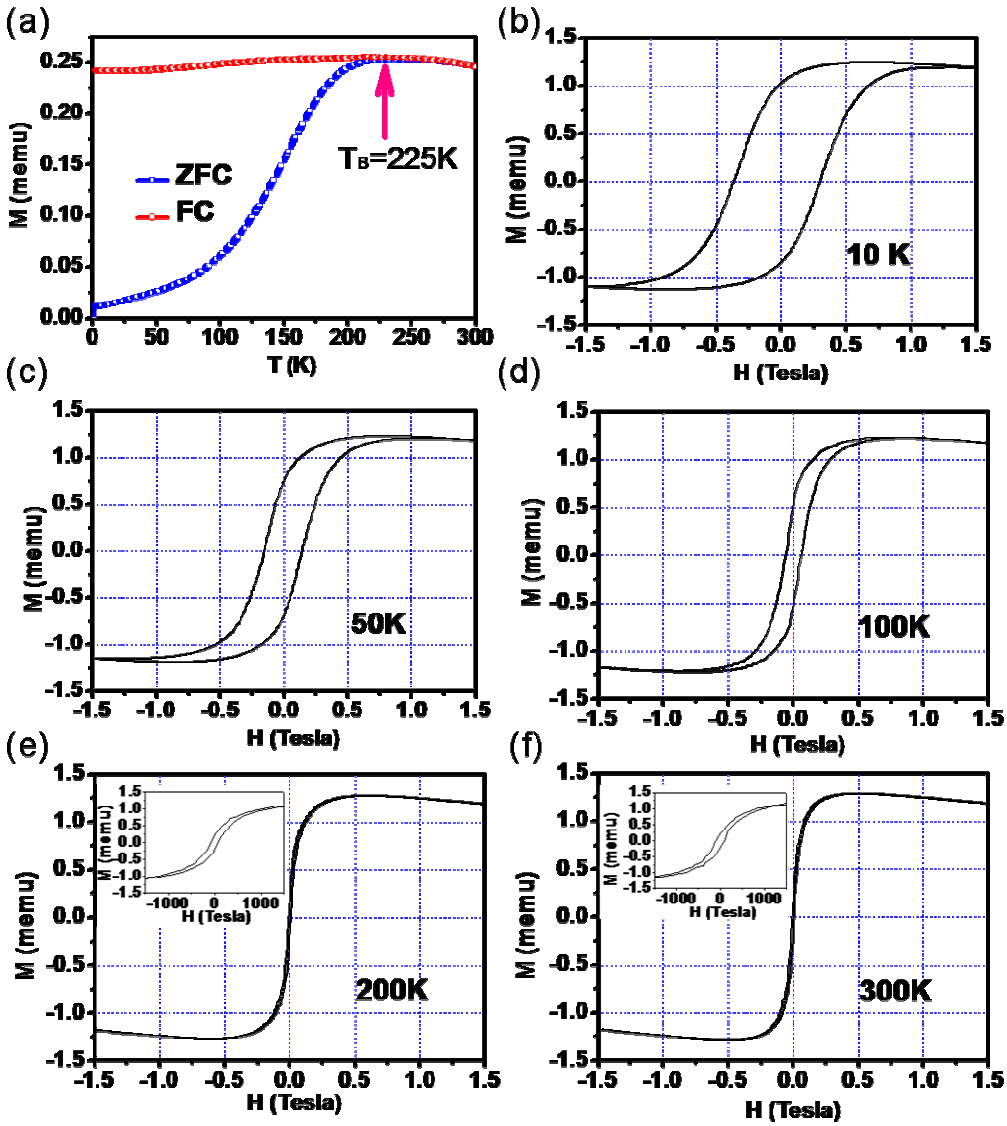

Figure S3 Zero-field-cooling (ZFC) and field-cooling (FC) measurement of as-synthesized Au_{core}-Co_{shell} nanoparticles in (a) give blocking temperature, T_B~225K, indicating superparamagnetic behavior of as-synthesized core-shell nanoparticles; and magnetic hysteresis loop with decreasing coercivity as temperature increase from 10K, 50K, 100K, 200K to 300K in (b), (c), (d), (e) and (f), respectively.

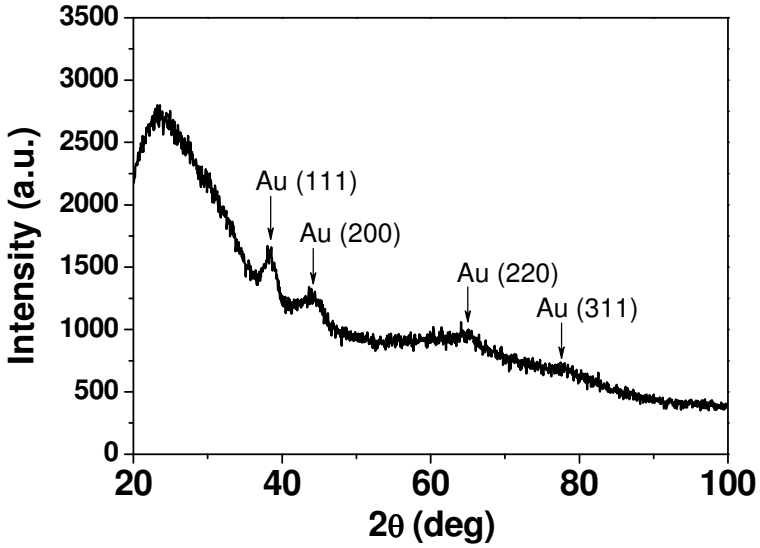

Figure S4 X-ray θ-2θ scan of as-synthesized Au_{core}-Co_{shell} nanoparticles by Cu$K\alpha$ radiation; only FCC Au peaks are seen. The absence of cobalt diffraction peaks is due to the small cobalt grain generated by heterogeneous nucleation.

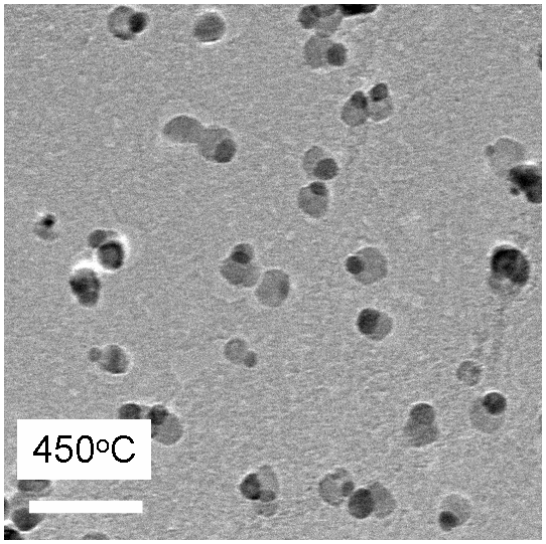

Figure S5 Bright field TEM image of Au_{core}-Co_{shell} nanoparticles after being annealed at 450°C for 10 hours. The scale bar is 30nm.