SUPPLEMENTARY M ATERIAL

Calculation of the interparticle distance in the magnetic measurements: An order of magnitude of the mean interparticle distance <d> may be calculated, assuming a regular distribution of pseudo-spherical particles, as,

$$< d >= \frac{D}{2} \cdot \sqrt[3]{\frac{4\pi}{3 \cdot x_v}} \qquad (1)$$

where D is the mean particle diameter, and xv the volume fraction.

XRD simulation:

The powder patterns expected for nanospheres, nanorods and nanodisks of the phases relevant to Co (hcp, fcc, ε-Co) were simulated to form a qualitative reference. Given the desired shape and crystal phase, first the positions of all atoms inside the nanocrystal were generated. For this study, no defects were introduced into the nanocrystals. Following that, the list of all pairwise interatomic distances (r_{ij}, with i and j denoting i-th and j-th atoms) within the crystal are calculated. The list of r_{ij} is all the information relating to nanocrystal structure that is required for an exact calculation of the powder pattern [Guinier]. However, it is computationally more efficient to bin the list of distances into a histogram and use the approximate expression,

$$I(q) \propto \frac{F^2(S)}{S} \sum_k^N \frac{p_k}{r_k} \sin(2\pi r_k S)$$

where $S = 2 \sin(\theta)/\lambda$ is the scattering parameter, I(q) is the observed intensity, r_k is the value of r at center of a 'bin' and p_k is the number of occurrences of interatomic distances falling within the bin centered around r_k [Monot, Wickham]. N is the total number of bins. The bin widths are 10^{-3}-10^{-2} Å and are small enough that the simulated pattern is insensitive to further decrease of the bin width. F(q) is the atomic structure factor, in our case, of cobalt. Note that the expression given is a simplified form that applies to particles made of only one chemical species. For multi-species particles, more than one structure factor is involved and a slightly more careful binning procedure may be called for.

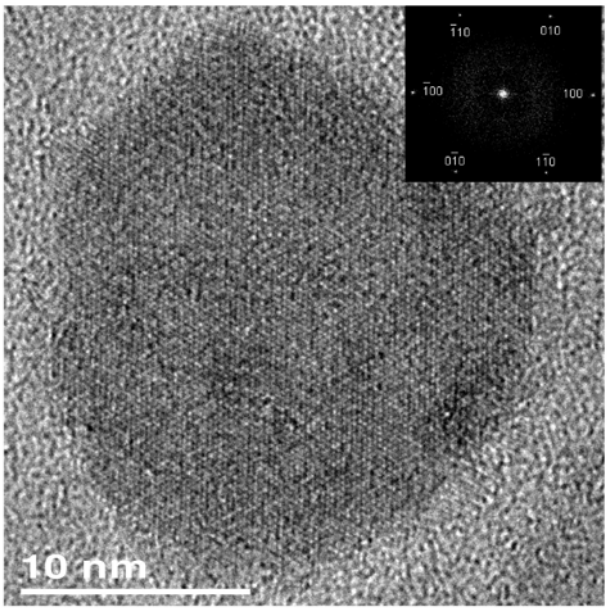
References:

[Guinier] A. Guinier, X-ray diffraction in crystals, imperfect crystals, and amorphous bodies, **1963**, San Francisco, W.H. Freeman

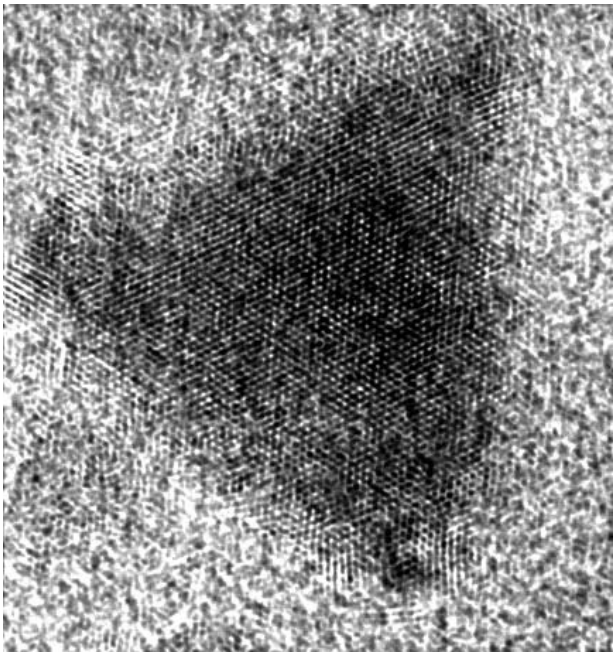
[Monot] B.D. Hall, R. Monot, Computers in Physics, *5*, 414-7

[Wickham] Juanita N. Wickham, Amy B. Herhold, and A. P. Alivisatos, Physical Review Letters, **2000**, *84*, 923-926

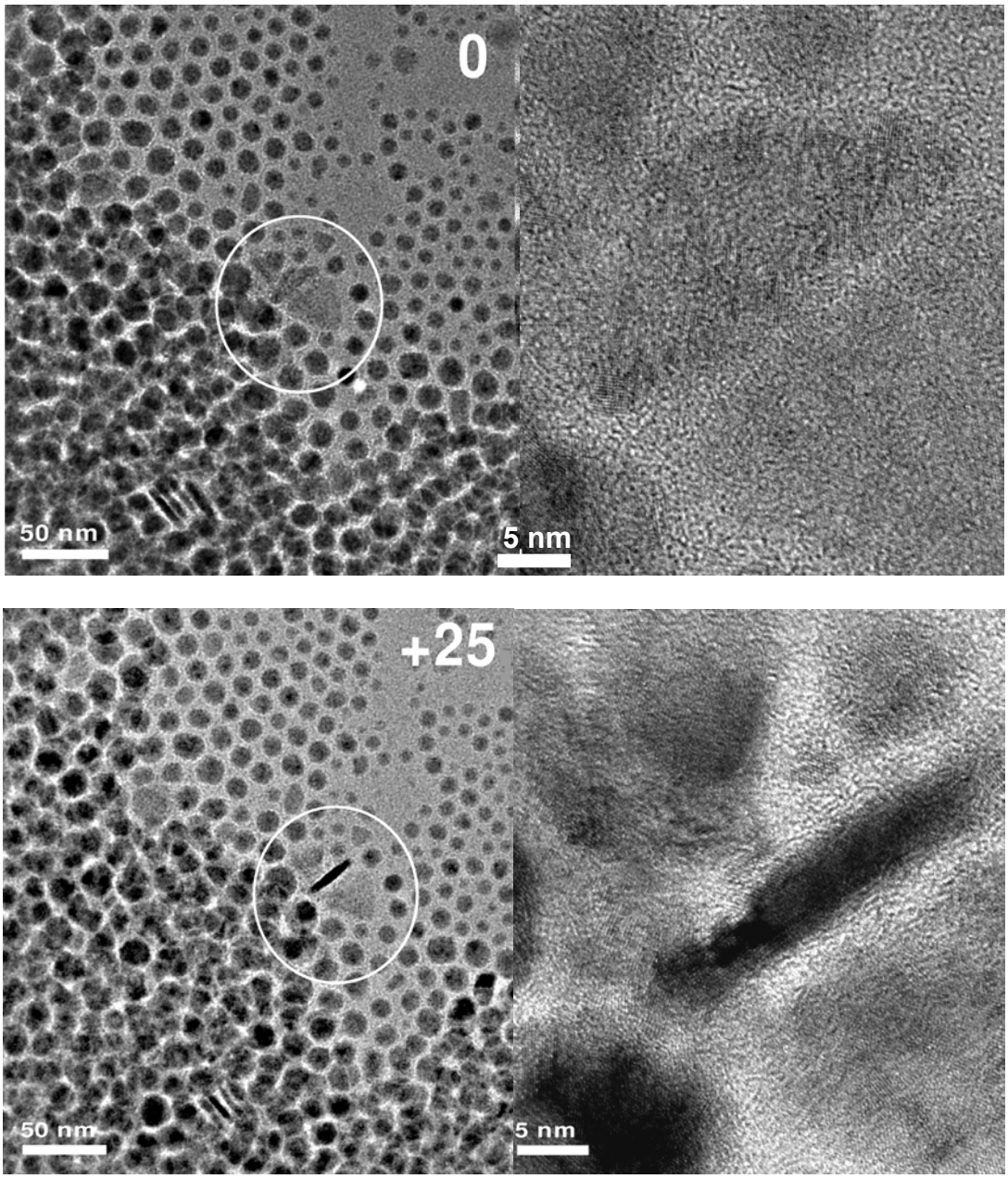
High Resolution Transmission Electron Microscopy



HRTEM of a flat Co disk. The lattice fringes show an hexagonal symmetry corresponding to the projection in the [001] direction. Inset: the Fourier transform of the image.

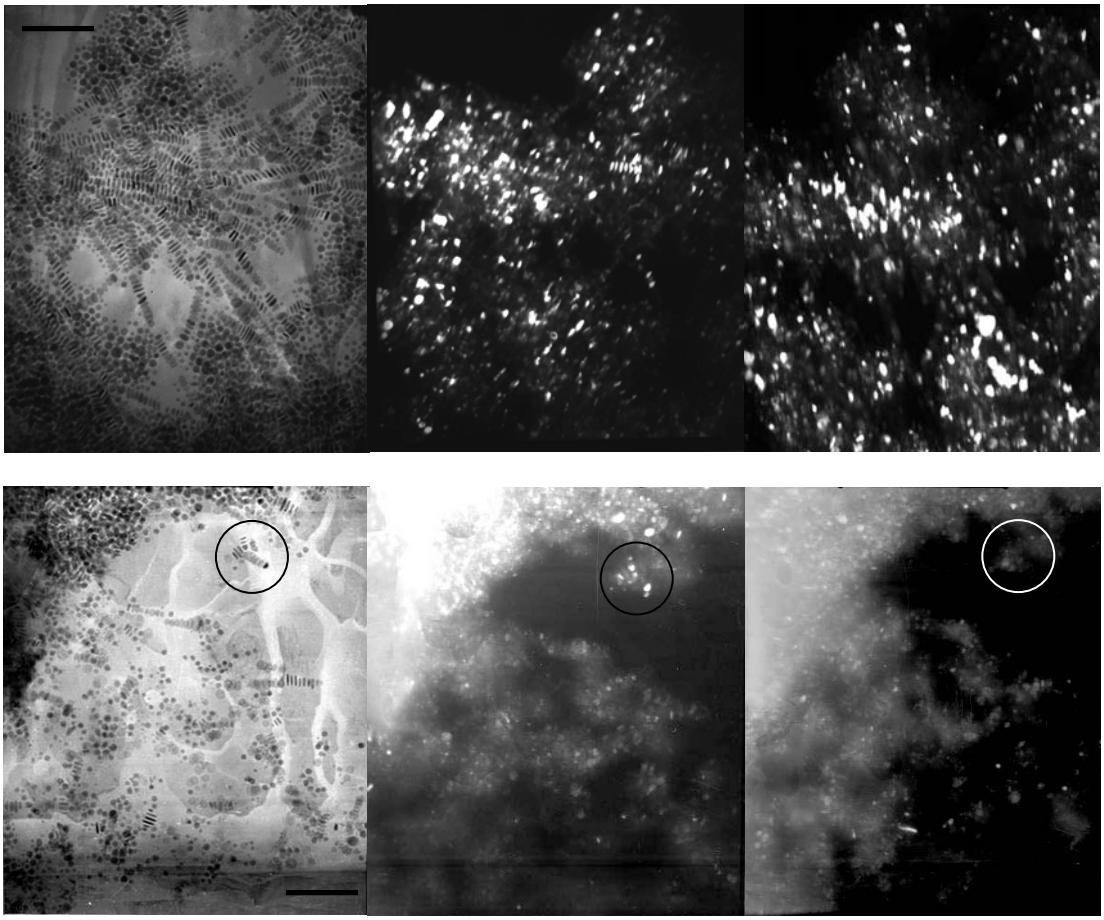


HRTEM of a triangle shaped Co nanocrystal.



TEM pictures of tilting experiments and HRES TEM of a triangle-shaped Co nanocrystal.

Dark Field Tem



Dark Field TEM on flat and standing Co nanodisks corresponding to two different diffraction reflections. Circles indicate matching areas. Bar are 100 nm.