Ethylenediamine based Compounds as Additives to Control the Morphology of Magnetite Nanoparticles Using Green Reaction Conditions

Laura Norfolk,*[a] Klaudia Kapusta [a], David Cooke [b], and Sarah Staniland[a]

Supplementary information

Additive study: Individual Histograms

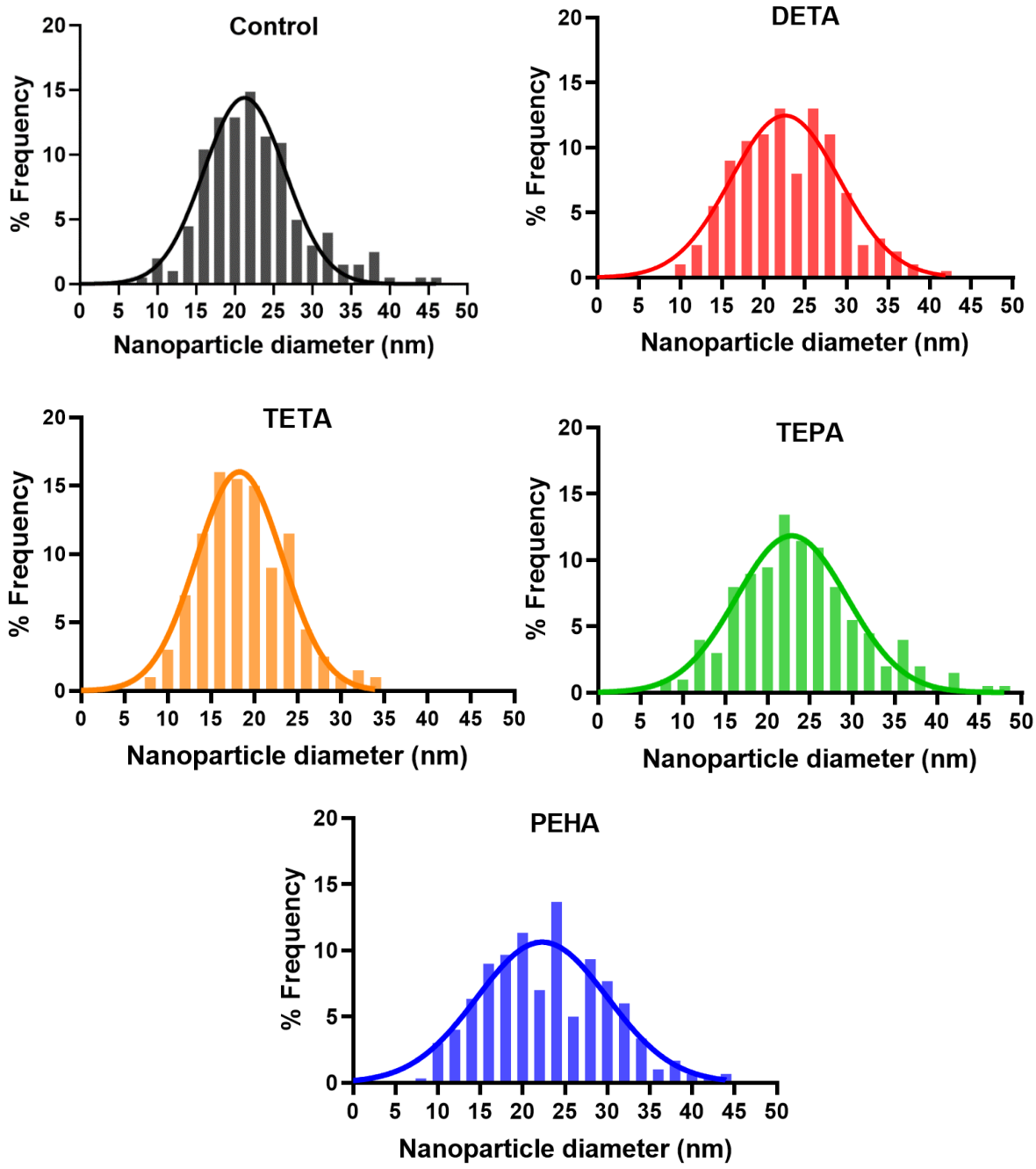


Figure S1. Individual histograms of MNP formed in RTCP reactions with the addition of varying additives: **a)** No additive (control); **b)** DETA; **c)** TETA; d) TEPA; e) PEHA

Particle Sizing Methodology:

Particle measurements are taken across the longest axis of each particle to ensure consistency between measurements using ImageJ software. Approximately 200 measurements are taken from each sample to get an accurate measure of mean size given the variety in particles per sample. To avoid human bias in which particles are selected for analysis, particles are analysed from a single "area" of a TEM image to prevent small or large particles being selectively measured. Several images are analysed for each sample to ensure a representative sample is taken.

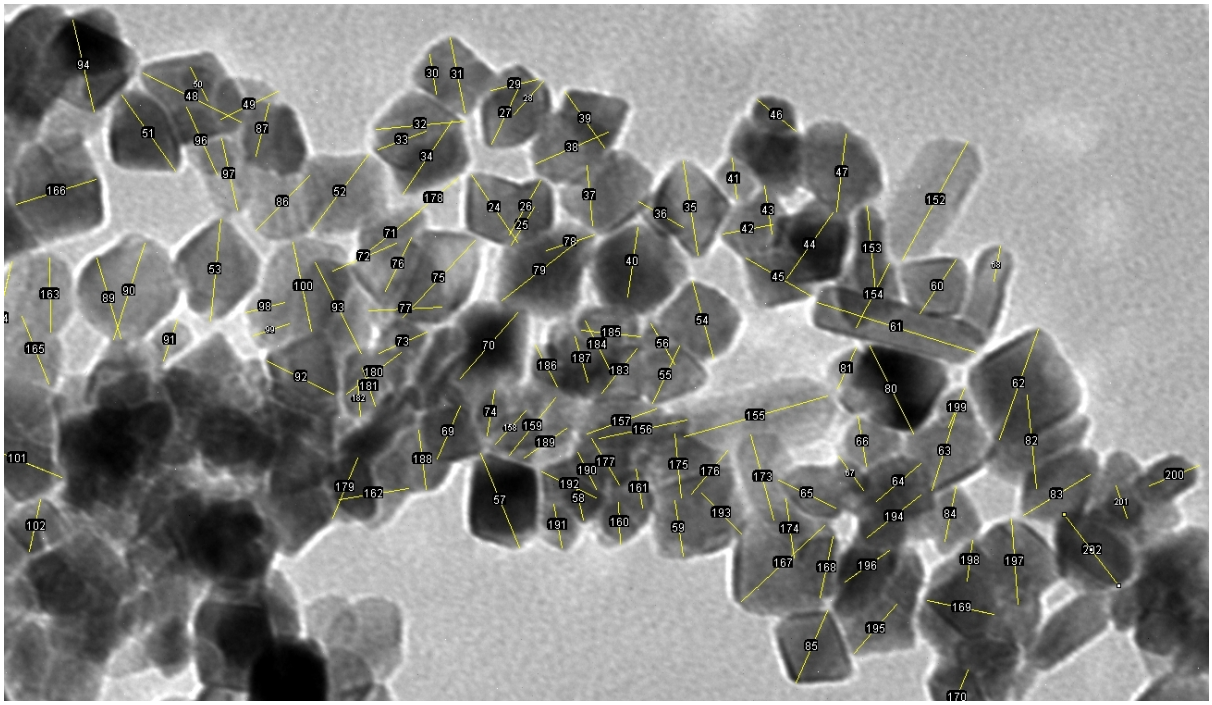


Figure S2: Screenshot of ImageJ particle sizing showing particles are analysed in clusters.

Particle Shape Analysis Methodology:

Images are manually analysed using drawing software (Inkscape, Paint.net, etc) by marking each particle a shape with a set colour (figure S3). A minimum of 300 samples are marked from several different images to ensure a representative sample is selected. The particles are then counted, at which point the shape assignment is checked a secondary time to maximise accuracy. Sample particle shapes can be seen in figure S4.

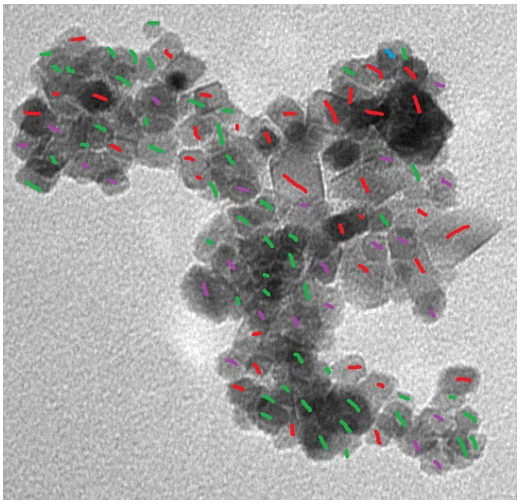


Figure S3. Example image analysis showing octahedral (red), undefined (green), and hexagonal (purple) particles.

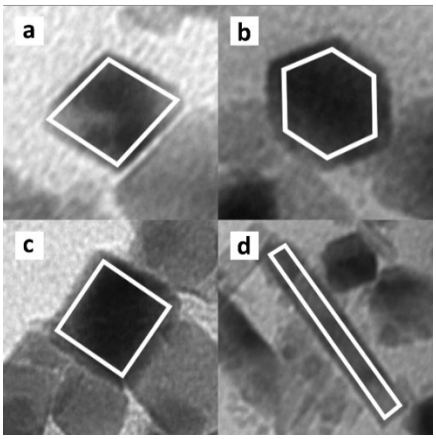


Figure S4. Sample particle shapes from TEM analysis; **a)** Octahedral; **b)** Hexagonal; **c)** square; **d)** rod/elongated.

Faceted Particle Breakdown: Table S1

Sample	Octahedral (%)	Hexagonal (%)	Square %	Rod (%)	Undefined (%)
Control	5	1	-	-	94
DETA	21	12	9	-	58
TETA	64	19	12	1	4
TEPA	62	18	15	2	3
PEHA	58	22	11	-	9

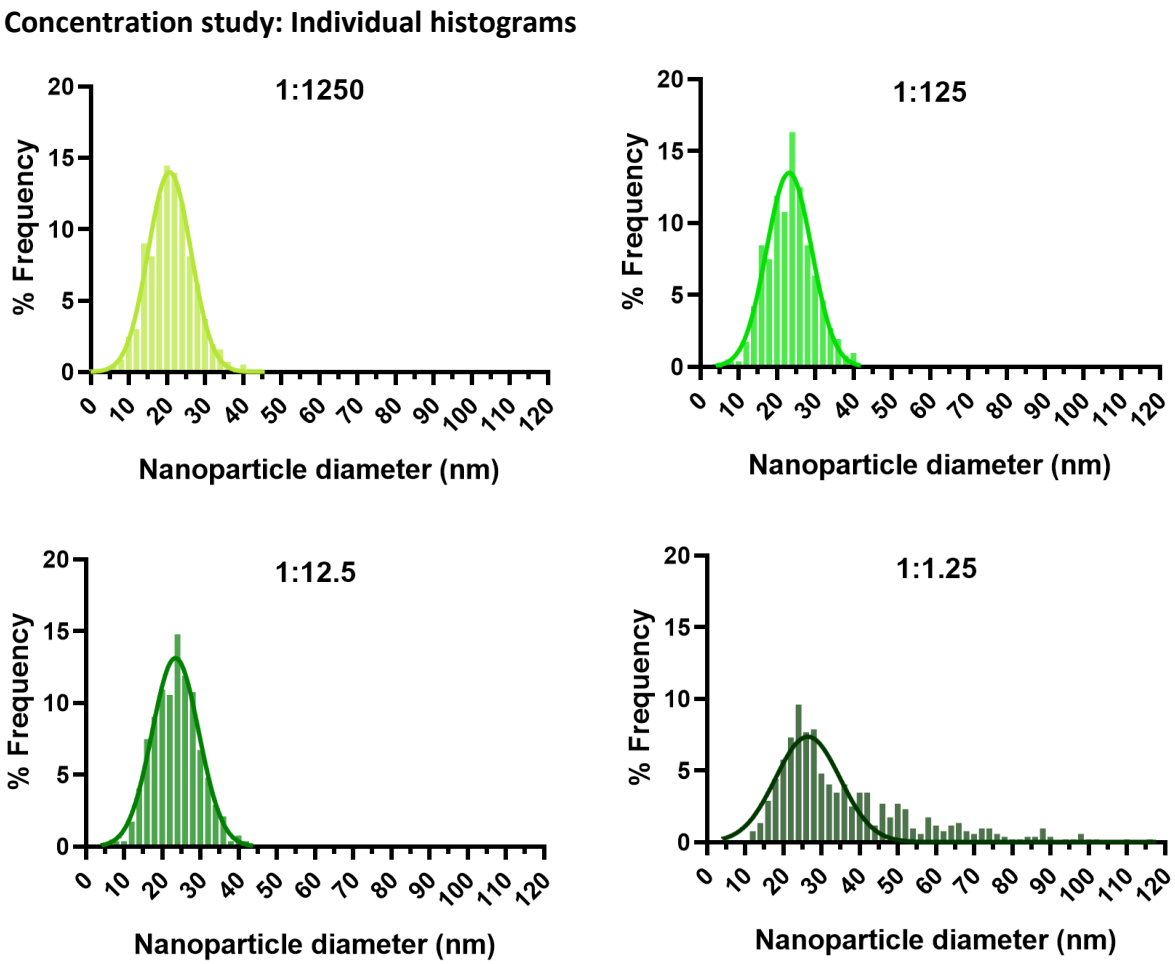


Figure S5. Individual histograms of MNP formed in RTCP reactions with the addition of varying iron:TEPA ratios: **a)** 1:1250; **b)** 1:125; **c)** 1:12.5; **d)** 1:1.25

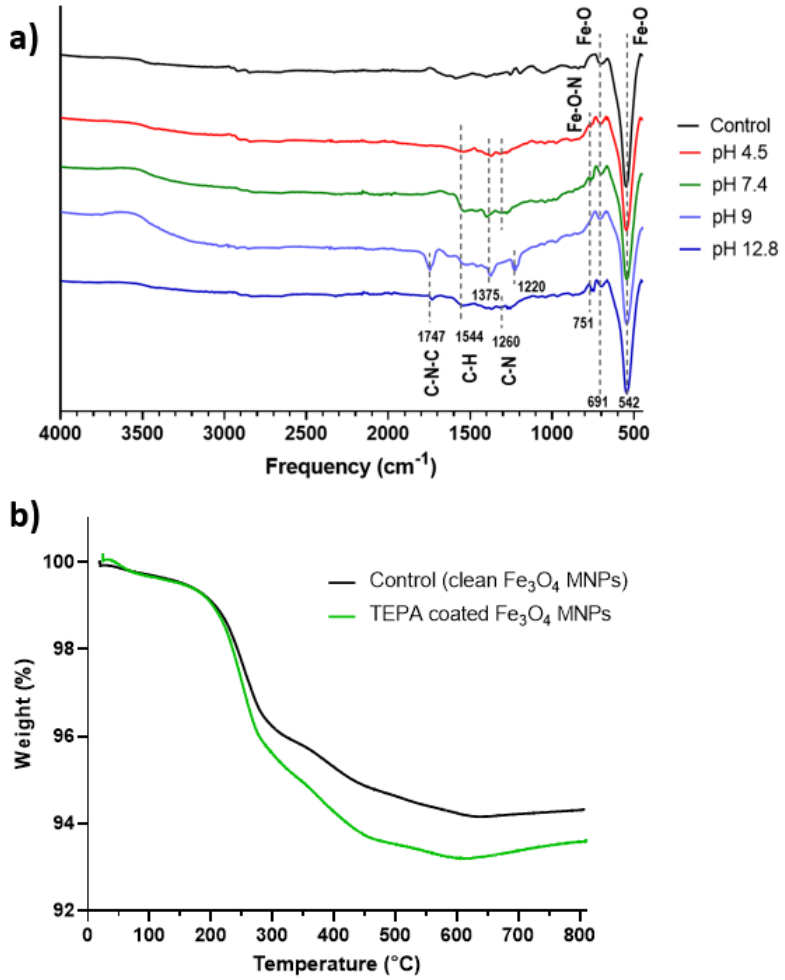
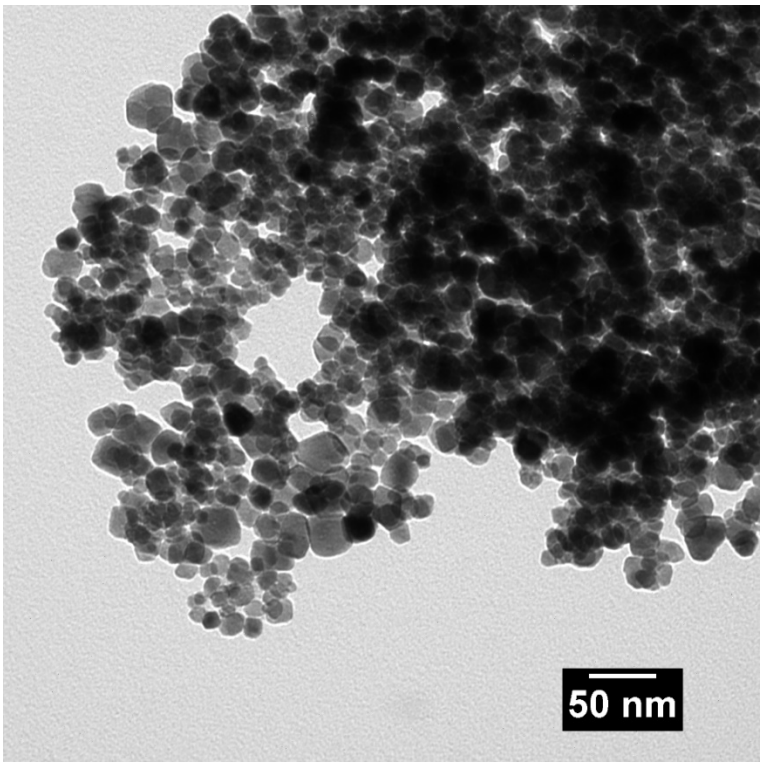


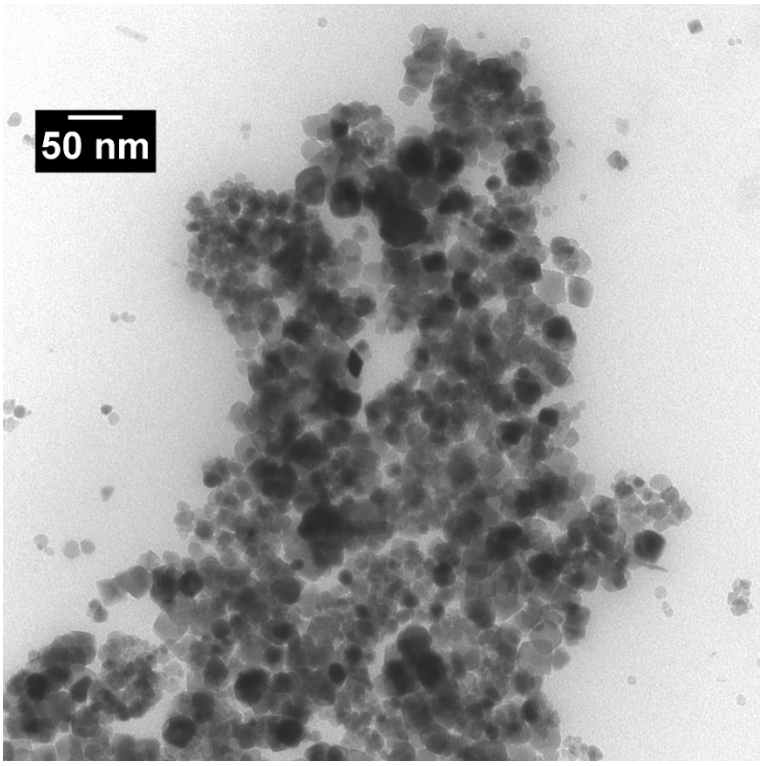
Figure S6. a) FTIR data of TEPA binding to magnetite nanoparticles at various indicated pH's; **b)** TGA of control magnetite nanoparticles (black) and TEPA bound particles (at pH 7).

Full size TEM images

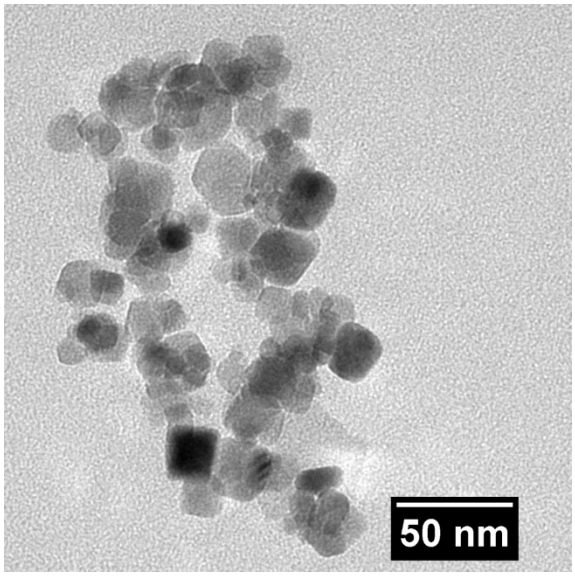
Control particles:

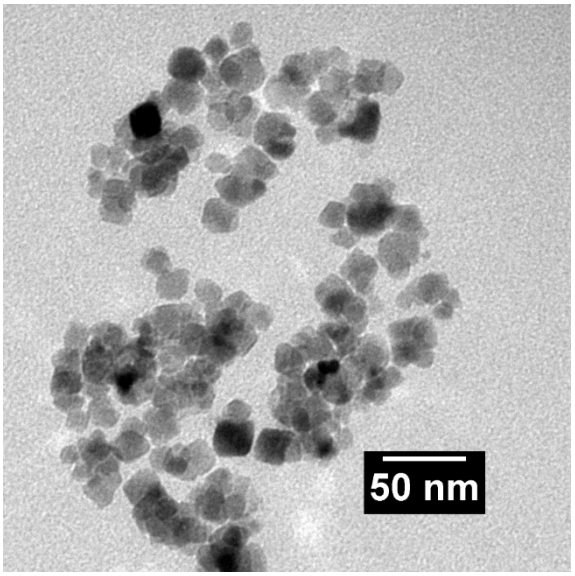


DETA:

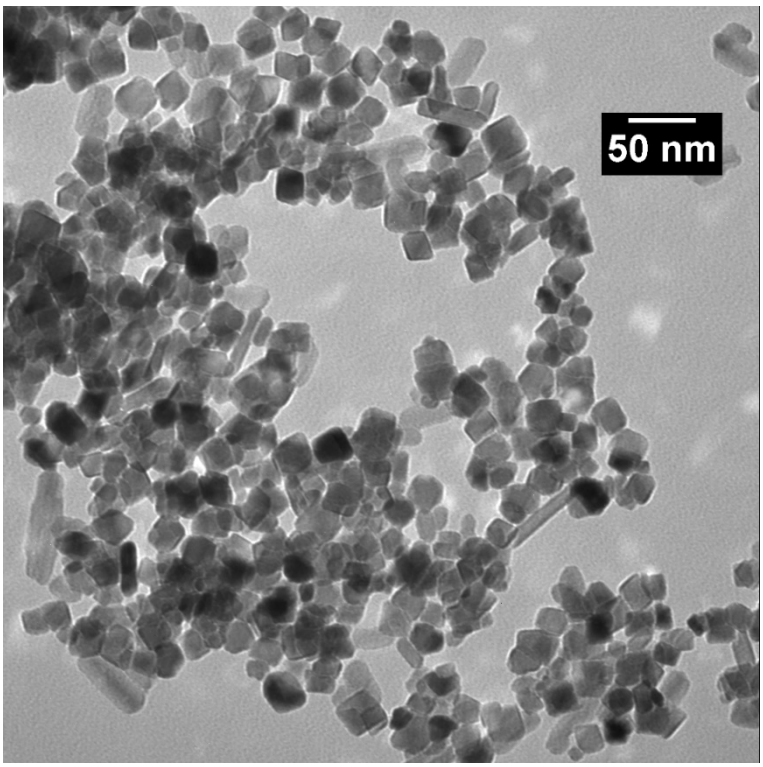


TETA:

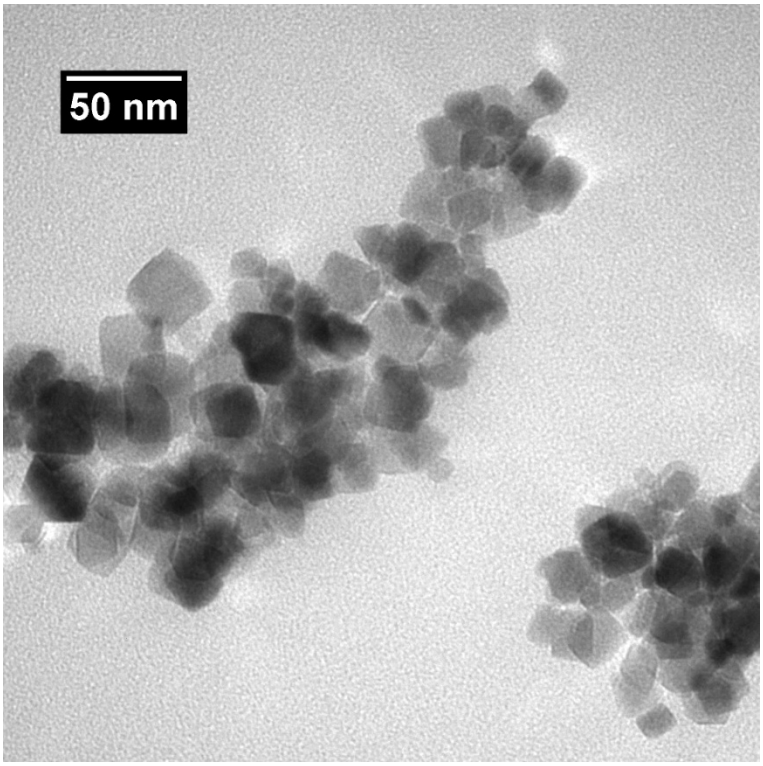




TEPA:

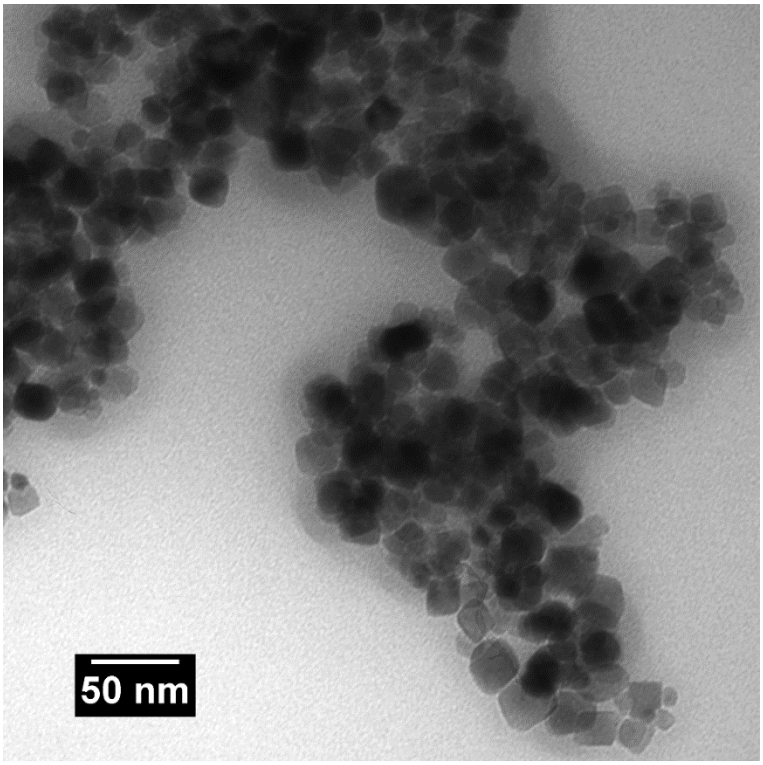


PEHA:

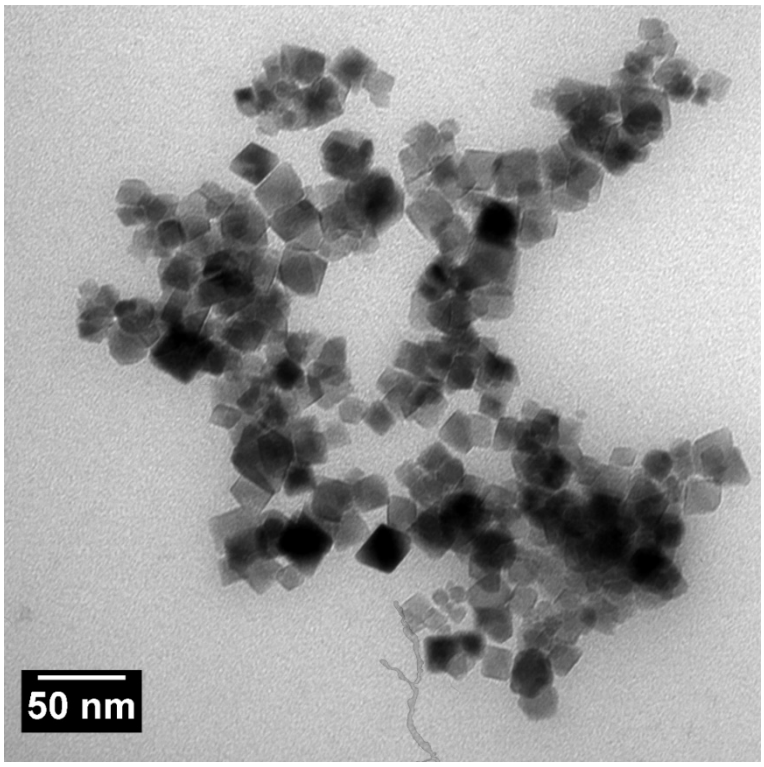


Full size TEM images:

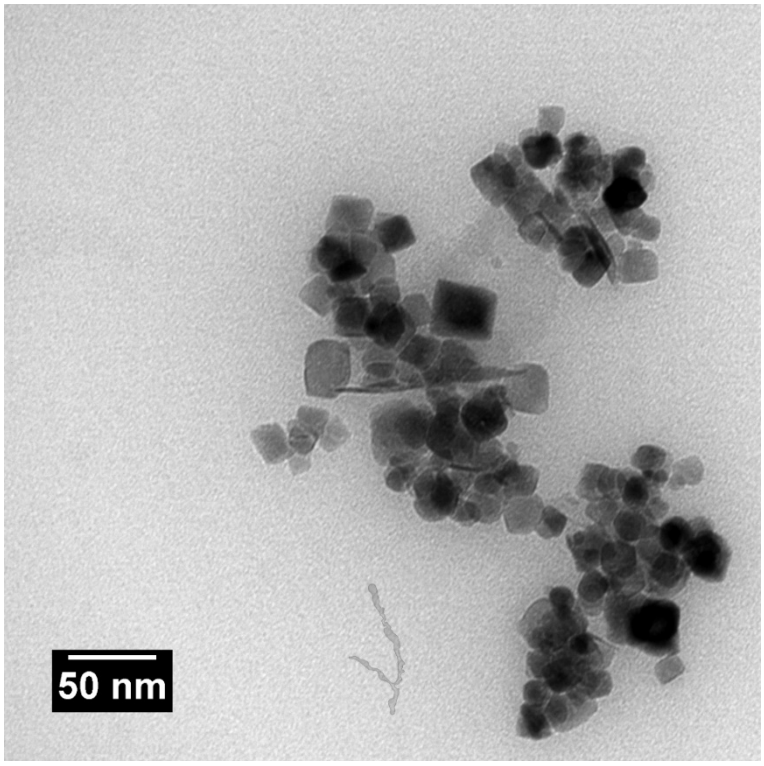
1:1250



1:125



1:12.5



1:1.25