Electronic Supplementary Material (ESI) for Journal of Materials Chemistry

Supplementary information

Electric field-assisted levitation-jet aerosol synthesis of Ni/NiO nanoparticles

Yu. G. Morozov,[a] O. V. Belousova,[a] M. V. Kuznetsov,[a,b] D. Ortega,[c,d] and I. P.Parkin[b]

[a]Institute of Structural Macrokinetics and Materials Science, Chernogolovka, Moscow Region, 142432, Russia. E-mail: morozov@ism.ac.ru

[b]Department of Chemistry, Materials Chemistry Centre, University College London, 20 Gordon Street, London, UK, WC1H 0AJ E-mail: i.p.parkin@ucl.ac.uk

[c]Department of Physics and Astronomy, University College London, WC1E 6BT London, UK, E-mail: d.ponce@ucl.ac.uk

[d]Davy-Faraday Research Laboratory, the Royal Institution of Great Britain, W1S 4BS London, UK

Table S1. Pearson's product moment correlation coefficient (*r*) and corresponding to the data from experiments carried out by combination mode in the presence of air. The parameters included in the analysis are: *E* is the electrical field, V_{MAG} the at.% Ni calculated from magnetometry measurements, *S* the specific surface area and <*d*> the average particle size obtained from TEM images.

Variables		*E*	V_{MAG}	*S*	<*d*>
E	*r*	1	0.80086	-0.80918	0.74112
	P-value	--	0.01691	0.01498	0.03539
V_{MAG}	*r*	0.80086	1	-0.5066	0.54073
	P-value	0.01691	--	0.20013	0.16643
S	*r*	-0.80918	-0.5066	1	-0.97445
	P-value	0.01498	0.20013	--	4.09142×10^{-5}
<*d*>	*r*	0.74112	0.54073	-0.97445	1
	P-value	0.03539	0.16643	4.09142×10^{-5}	--

Pearson's product moment correlation coefficient measures the strength of the linear relation between two variables. The closer the Pearson's coefficient to -1 (negative correlation) or +1 (positive correlation), the stronger the correlation between the compared parameters. The strongest correlation found for experiments performed in combination mode in the presence of air is between *S* and <*d*>, which makes sense since the surface area exposed will increase for decreasing particle sizes. A good correlation is also found for all the variables involving the electric field. For all these cases the P-value is less than 0.05, indicating a statistically significant correlation at the 5% significance level.

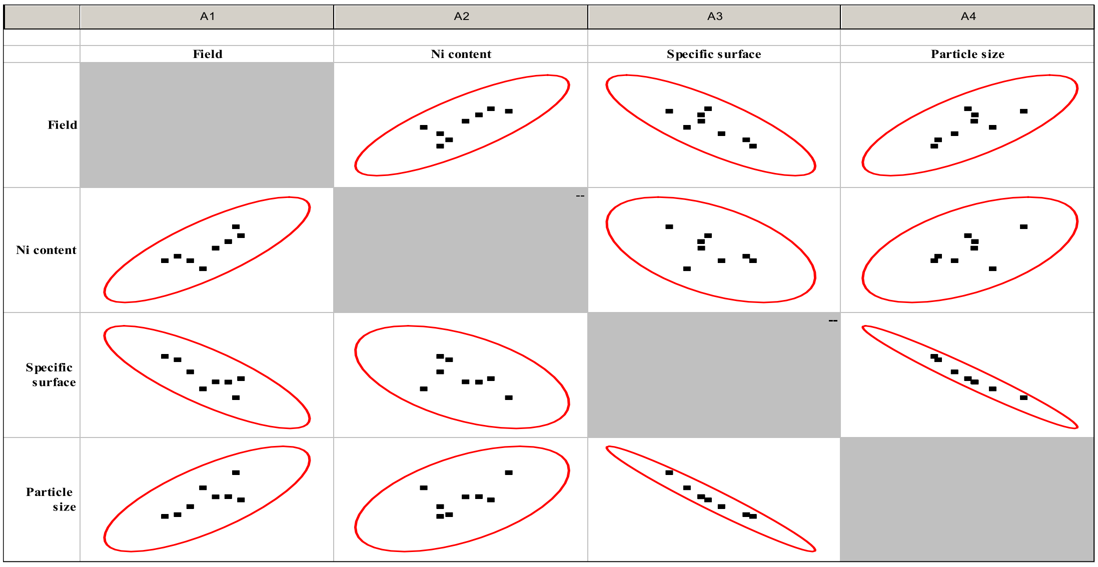


Fig. S1. Scatter matrix plots and 95% level confidence ellipses (red) corresponding to the data from the set of experiments carried out by combination mode in the presence of air.

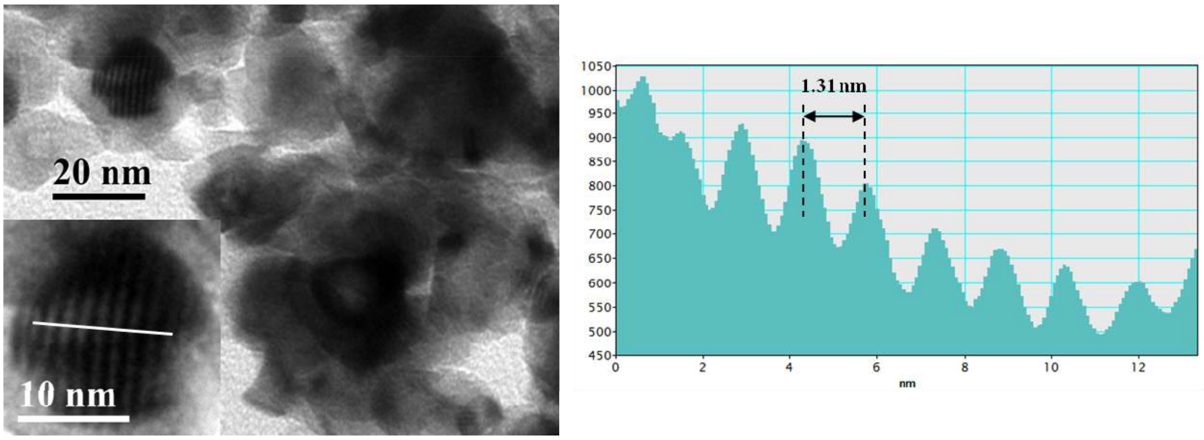
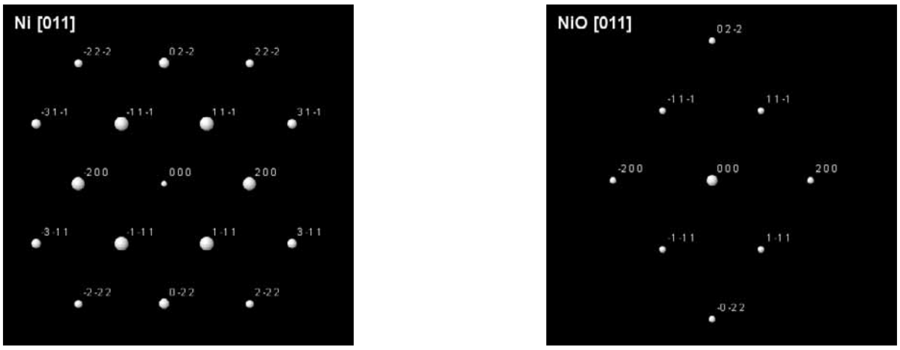
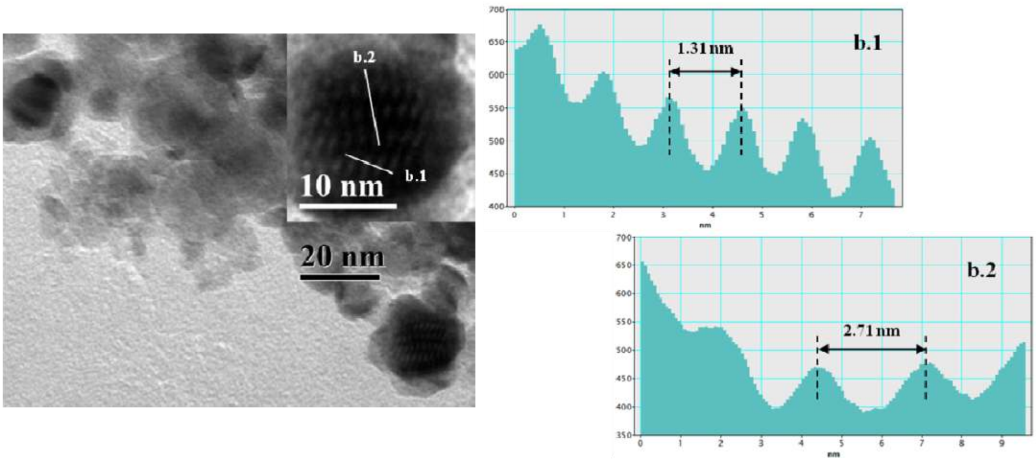


Figure S2. TEM image of sample No. 3. The spacing of the moiré fringes is indicated in the intensity profile at the right obtained from a linear section across the nanoparticle volume (white line in the inset).



a)



b)

Figure S3. (a) Expected diffraction patterns for Ni (left) and NiO (right) under the [011] zone axis; (b) TEM image of sample No. 3. The spacings of the moiré fringes are indicated in the intensity profiles at the right, which have been obtained from linear sections (b.1 and b.2) normal to the orientation of each set of fringes (white lines in the inset).

Crossing moiré patterns (like the one shown in Fig. S3b) are common when there are many planes diffracting at a zone axis. The measured b.1 moiré fringes are in agreement with the theoretical value expected for translational moirés from the superposition of the (111) planes of Ni and NiO, with $D_{moiré}$=1.32 nm. Considering the crystallography of the system and the epitaxial relationship expected between core and shell, the most compatible symmetry arrangement is under their common [011] zone axis (Fig. S3a), since both (200) and (111) planes will be present.

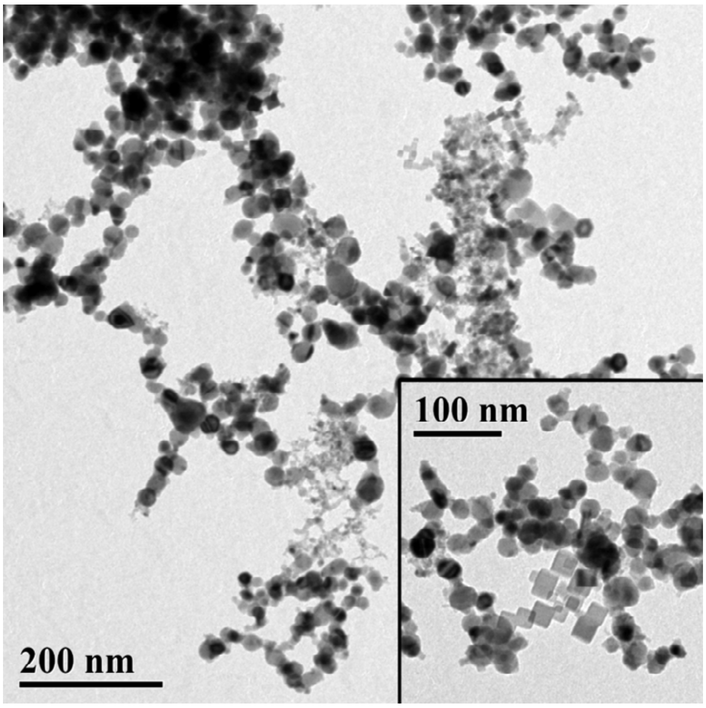


Figure S4. TEM images of sample No. 7 (zero applied field and pure He flow), showing one of the few regions where the formation of very small cubic nanoparticles takes place. Inset: coexistence of cubic and spheroidal nanocrystals of the same size.