

## Supporting Information

# Sodium niobate based hierarchical 3D perovskite nanoparticle clusters

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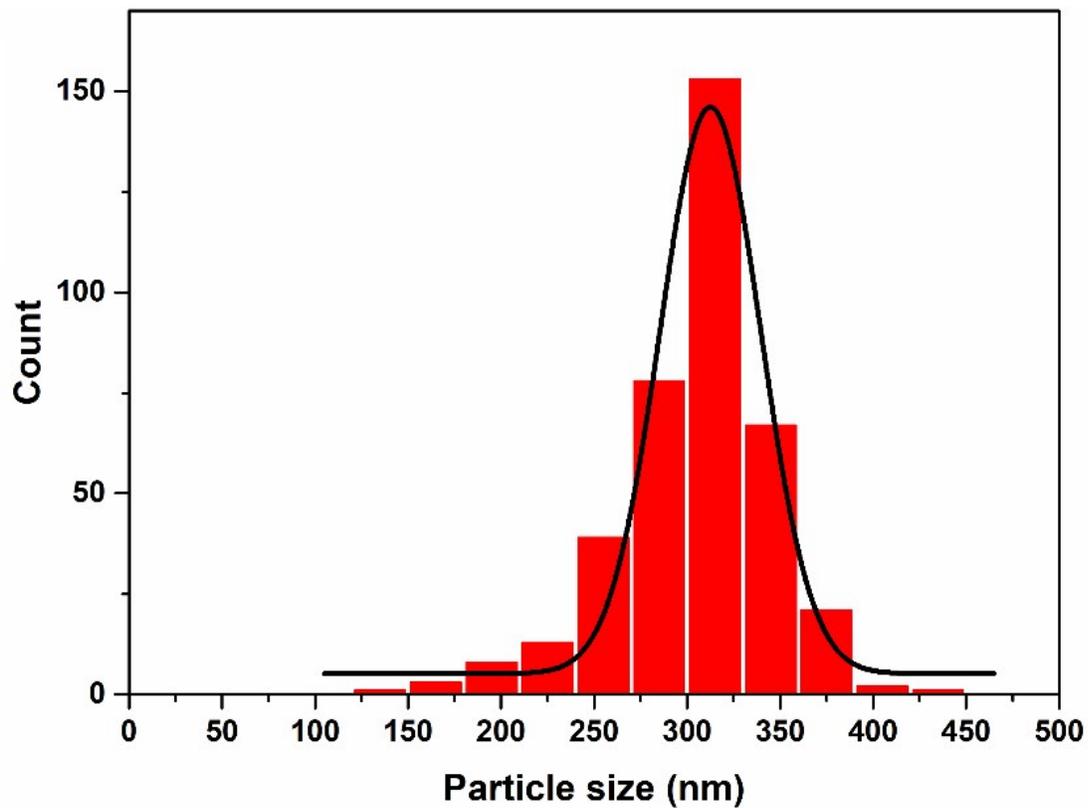
**Equation S1:** Scherrer equation for the crystallite size analysis. The analysis of the XRD profile for the evaluation of the average crystallites diameter  $d_{\text{xrd}}$  was conducted according to the Scherrer equation:

$$d = \frac{0.9\lambda}{FWHM \cos\theta}$$

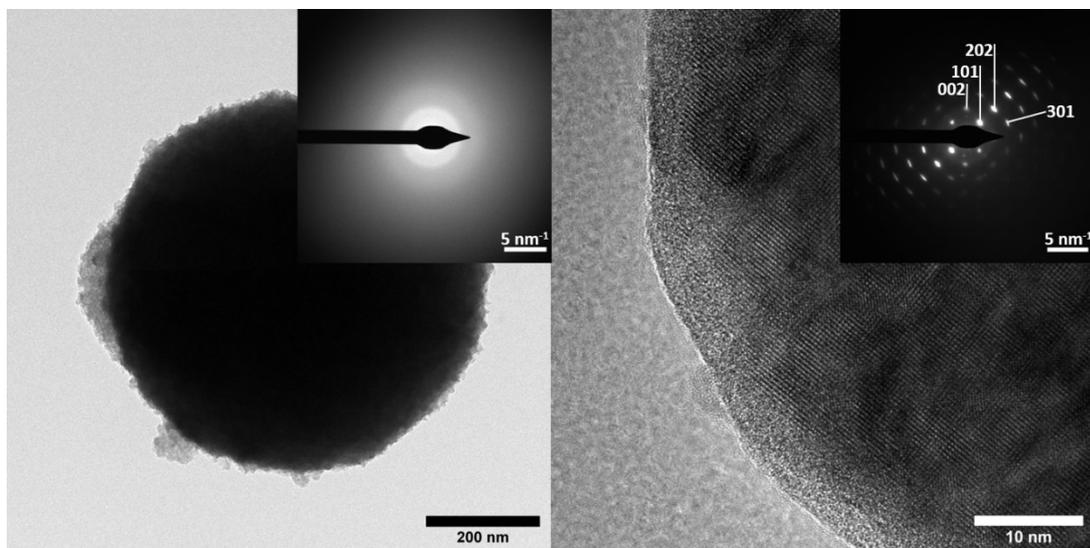
The FWHM was evaluated on the (002) diffraction peak.

**Table S1:** NN300 *Pmma* (space group number: 51) Refined parameters.

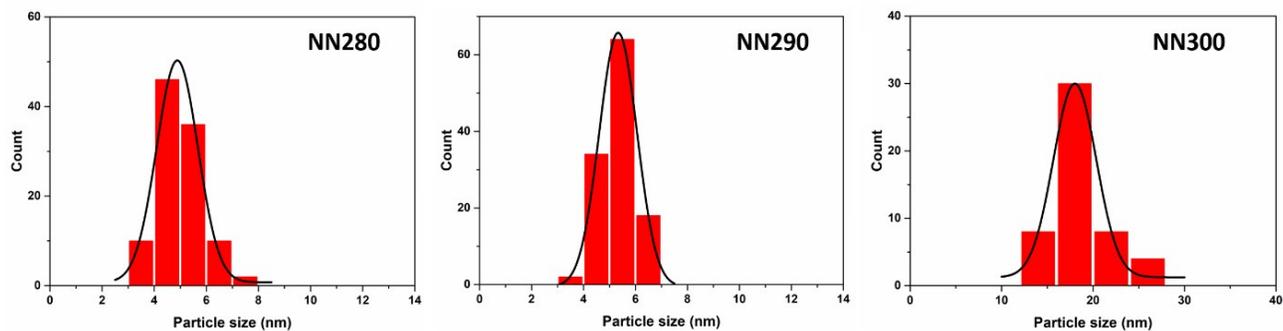
<b>Atom</b>	<b>x</b>	<b>y</b>	<b>z</b>	<b>Wyck</b>	<b>Lattice constants (Å)</b>	<b>Reliability factors</b>
Nb	0.75	0.749 (2)	0.751 (1)	4k	a = 5.522 (1)	R <sub>p</sub> = 7.02
Na1	0.75	0	0.247 (6)	2e	b = 7.804 (3)	R <sub>wp</sub> = 9.38
Na2	0.75	0.5	0.223 (7)	2f	c = 5.522 (1)	R <sub>ex</sub> = 4.73
O1	0.25	0	0.128 (5)	2e		
O2	0.25	0.5	0.180 (7)	2f		
O3	0	0.218 (4)	0.5	4h		
O4	0.5	0.292 (3)	0	4g		



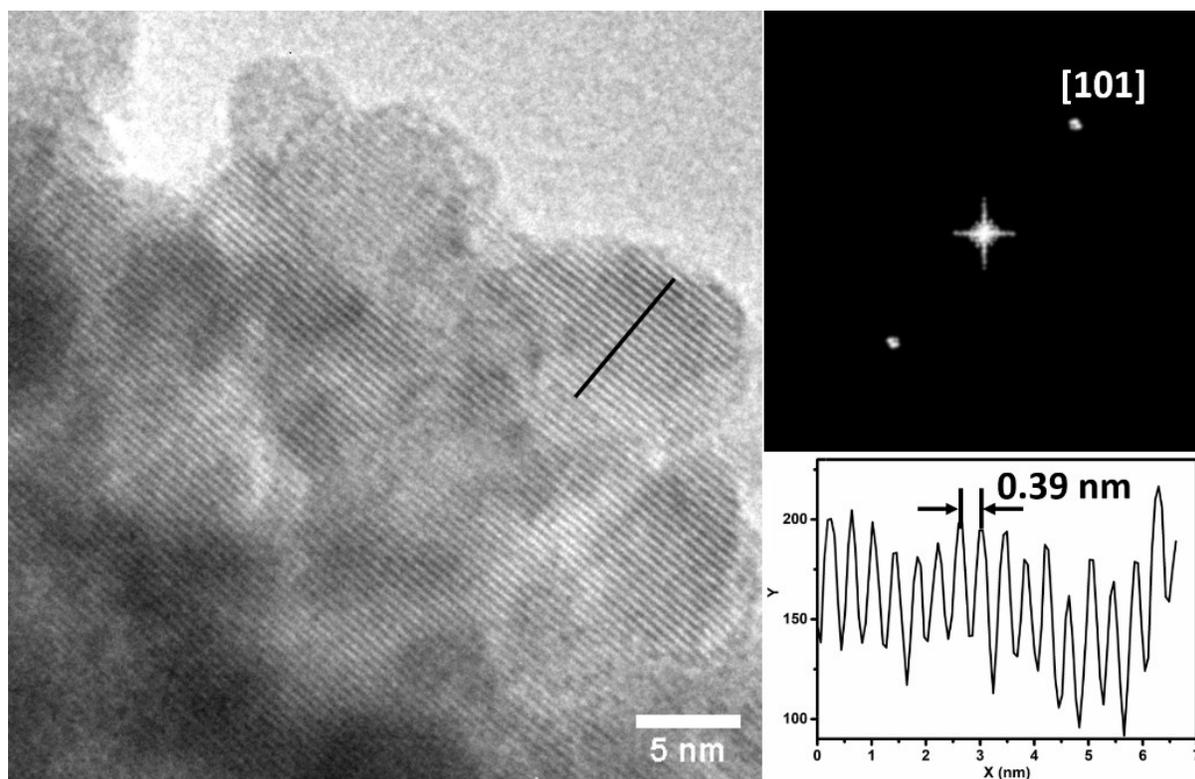
**Figure S1:** Particle size distribution sample NN300 obtained by SEM microscopy, mean particle size =  $312 \pm 25$  nm.



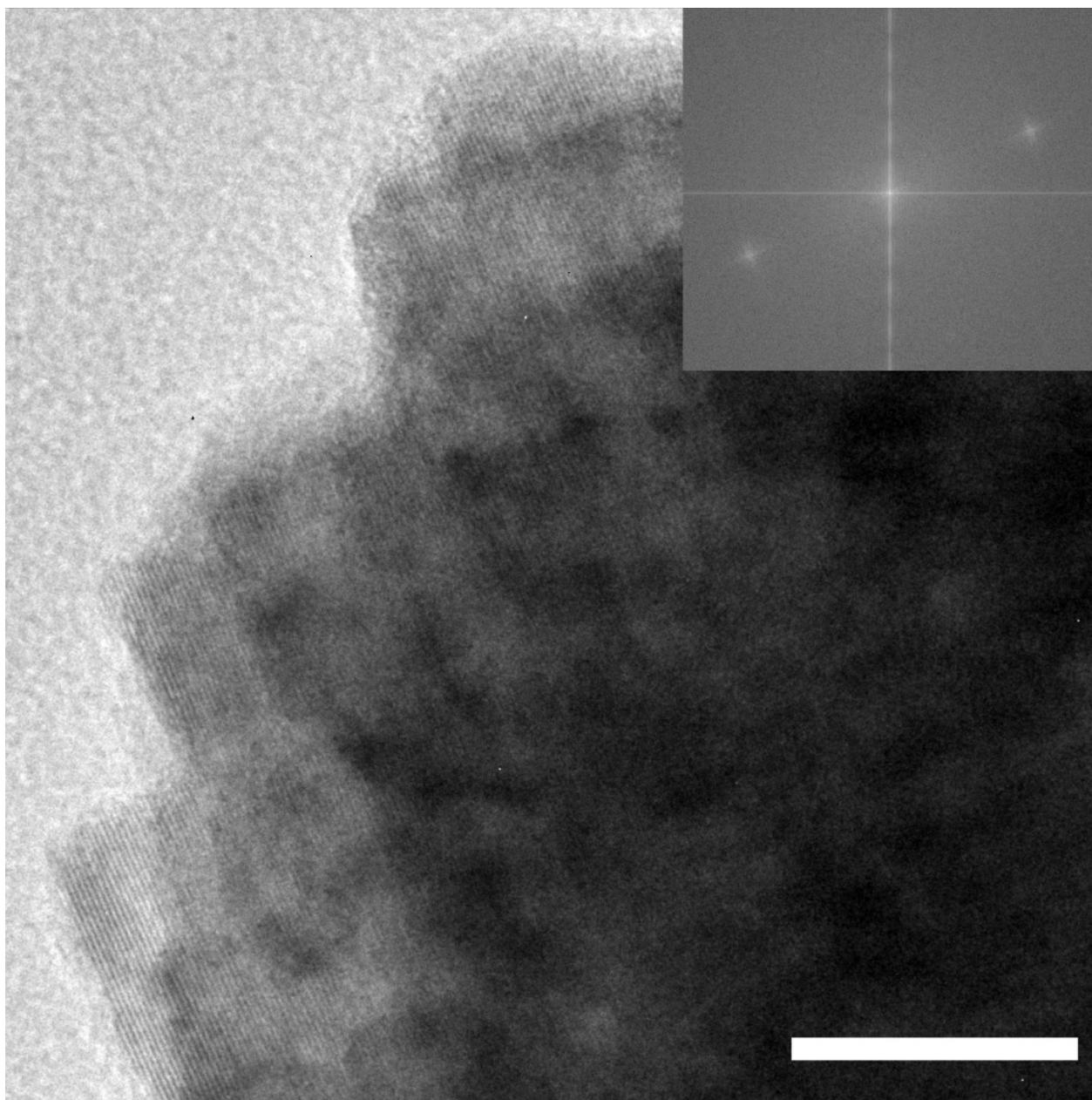
**Figure S2.** TEM images and SAED analyses of sample NN270, amorphous nanoparticle cluster (left) and high resolution image of a crystalline mesocrystal (right).



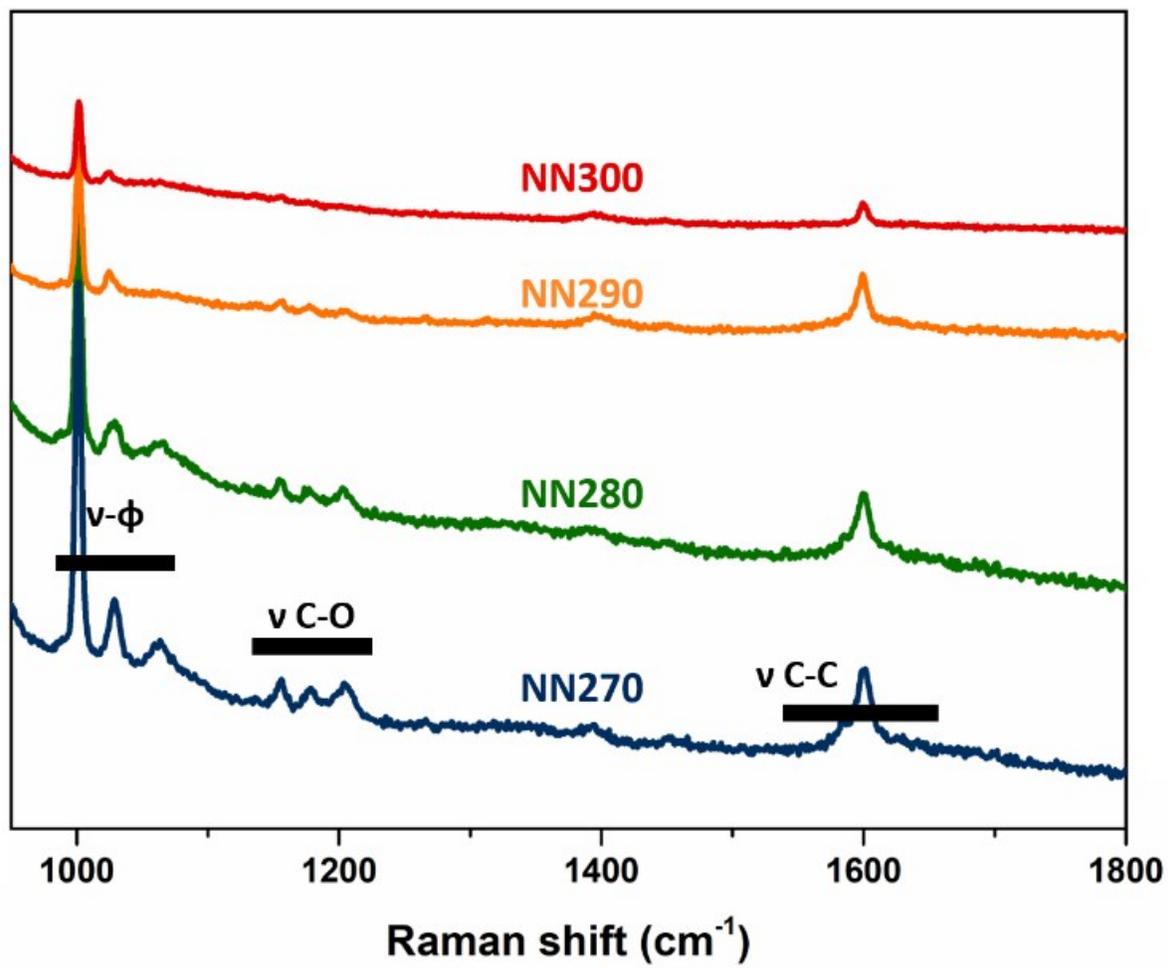
**Figure S3.** Particle size distribution of the PNPs for sample NN280 ( $5 \pm 1$  nm), NN290 ( $5 \pm 1$  nm) and NN300 ( $18 \pm 3$  nm).



**Figure S4:** TEM image of sample **NN280**, FFT and profile analysis of the line scan across the fringes. The analyses show the periodic fringe spacing around 0.39 nm, corresponding to the interplanar spacing along the [101] direction of *Pmma* NN.



**Figure S5:** TEM images of NN300 (scale bar 20 nm); inset: FFT analysis.



**Figure S6:** Raman spectra evidencing the organic groups in the NN270-300 samples.

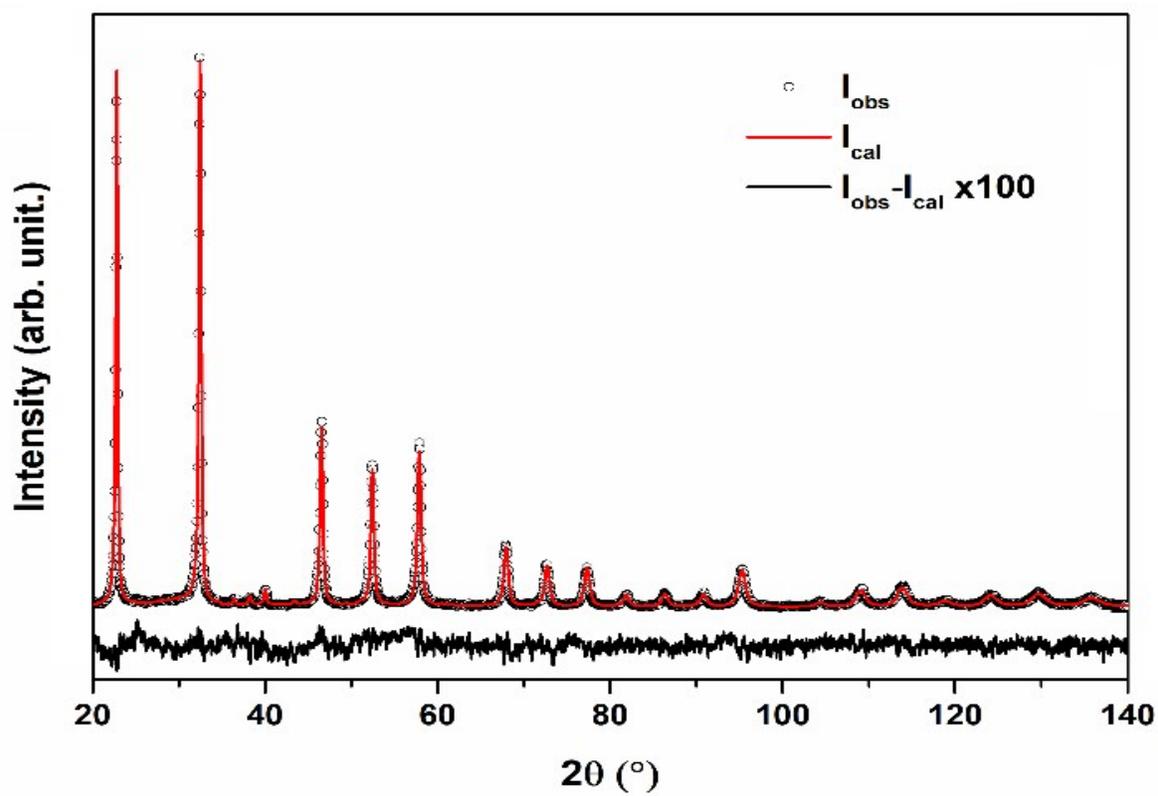
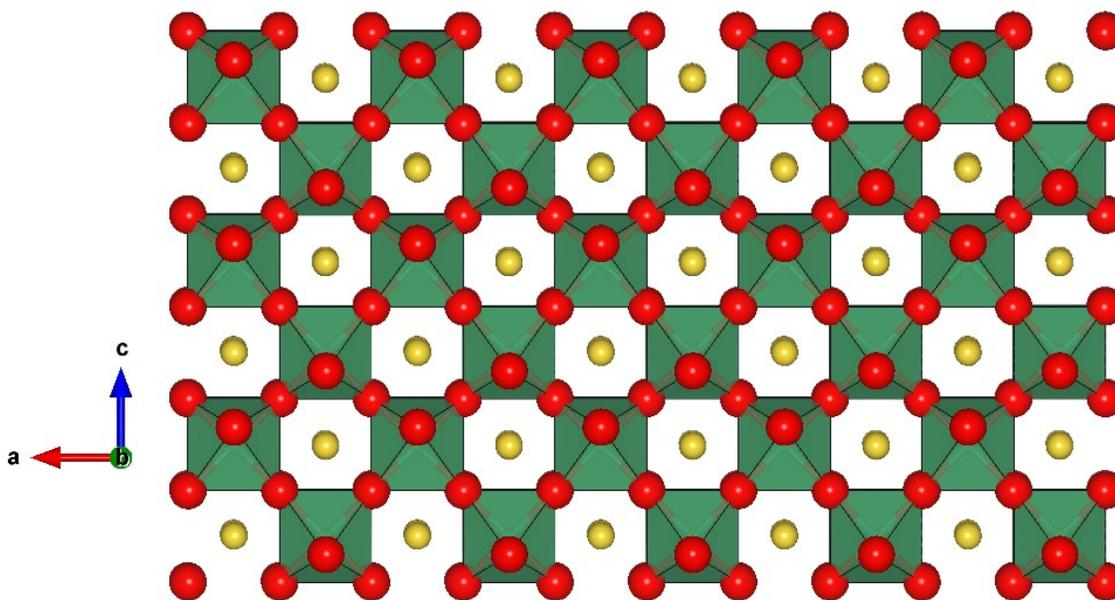
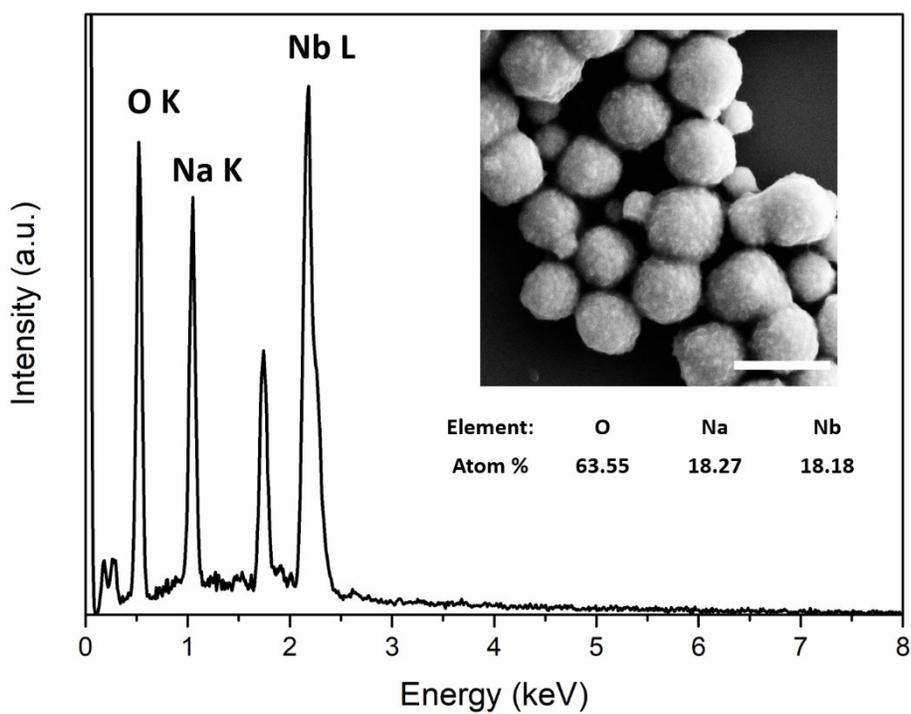


Figure S7: NN300 XRD data and Rietveld fitting using the *Pmma* phase.



**Figure S8.** representation of NN crystal structure along the [010] zone axis



**Figure S9.** SEM-EDS analysis of NN300 sample, the investigated area is reported in the inset.