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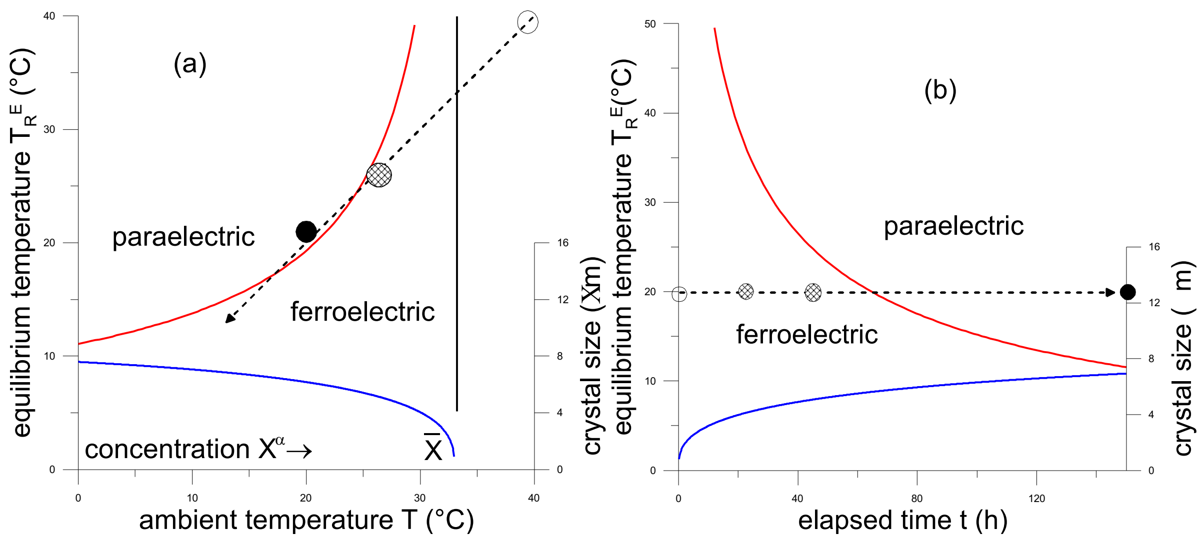
Ferroelectric Transitions in Small Particles

A. Umantsev, M. V. Astakhov and A. O. Rodin

B.



Caption: *Ferroelectric-paraelectric equilibrium temperatures (red curves) and crystal sizes (blue curves) in the cooling—(a) and drying—(b) experiments. Open circles—no crystals; closed circles—paraelectric phase; hatched circles—ferroelectric phase; black vertical line—precipitation temperature at the overall concentration* $\bar{X}$*. Directions of the arrows show time-arrows of the respective experiments.*

Scientific Achievement

In this article, the experiments on growth of small ferroelectric-salt particles from their aqueous solutions are analyzed with the help of the Landau-Ginzburg-Devonshire theory of phase transitions. Contrary to the most common trend, the paraelectric-ferroelectric transition temperature is found to increase with the decreasing size of the particle. This is attributed to the electrocapillarity effect that is, decrease of the surface energy between the particle and its solution with the emergence of the charge on it. The theoretical analysis found that the electrocapillarity effect here is due to the depolarization field of the spontaneously polarized ferroelectric phase. Application of the theory to the experiments on quasi-static cooling and drying of aqueous solutions of ferroelectric salts resulted in quantitative explanation of the experiments.

Significance

Small ferroelectric-salt particles become very popular in many different industries, e.g. recording one. One of the efficient ways to fabricate them is to grow from aqueous solutions. In this publication, we make suggestions regarding novel experiments, which may clarify properties of small ferroelectric-salt particles and help design new methods of their fabrication.

Citation

A. Umantsev, M. V. Astakhov and A. O. Rodin, "Ferroelectric transitions in small particles", Ferroelectrics 2017, **515**, 101–111 http://dx.doi.org/10.1080/00150193.2017.1367214