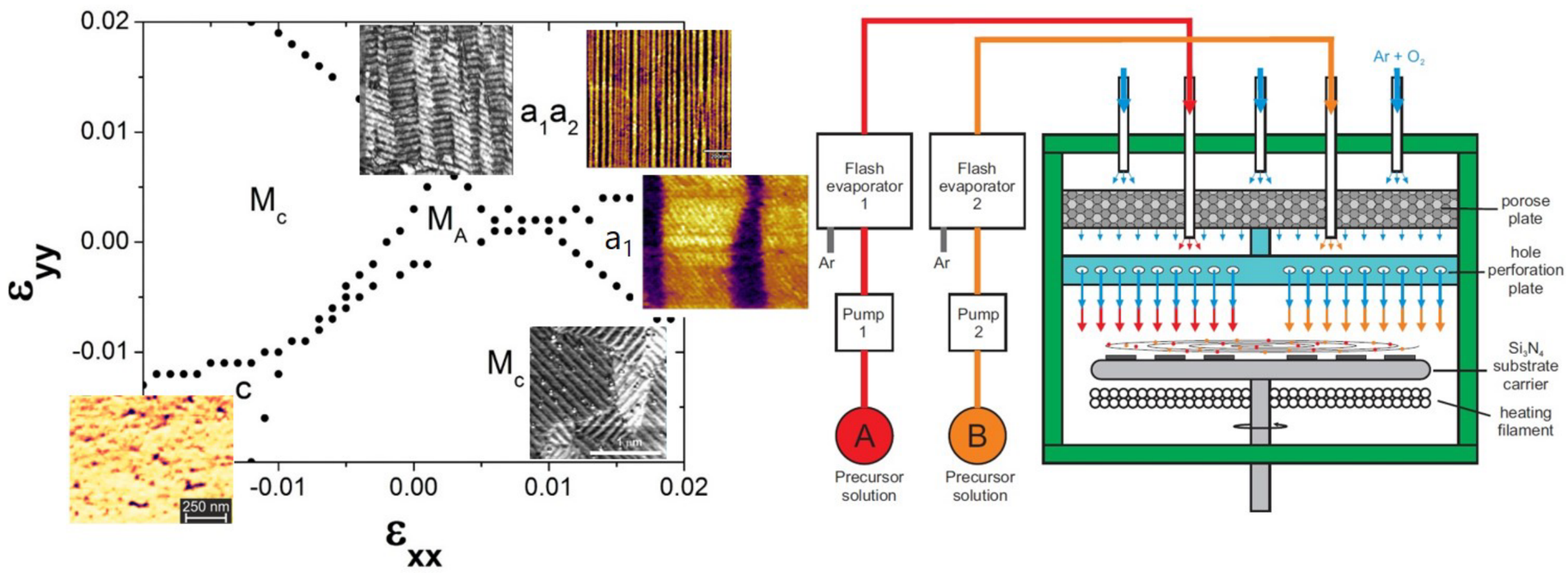
NANOSCIENCE COLLOQUIUM

Epitaxial growth of lead-free ferroelectric (K,Na)NbO3 thin films and the impact of strain

Dr. Jutta Schwarzkopf, Leibniz-Institut für Kristallzüchtung, Berlin

Abstract: A promising way to tune the ferroelectric properties of complex oxides is to deliberately modify the crystalline structure of these materials. This can be achieved by the deposition of thin oxide films, where lattice strain is introduced by the heteroepitaxial growth on lattice mismatched substrates. However, a directive tuning of the functional properties of thin films requires a detailed understanding of the correlation between lattice strain and ferroelectric phase formation as well as the availability of oxide substrates with tailored lattice mismatch. A very suitable growth method that permits the growth of high-quality layers for this purpose is given by the metal-organic vapor phase epitaxy (MOVPE) technique. It offers the advantages of high oxygen partial pressure, independent control of all constituents, growth nearby thermodynamic equilibrium and large scale-up potential. In my talk, I will discuss the influence of lattice strain in the material system Potassium-Sodium-Niobate (K,Na)NbO3. (K,Na)NbO3 is a lead-free, environmentally friendly material which offers as bulk material excellent piezoelectric and electromechanical properties, high Curie temperature and good thermal stability. However, for most applications (like memory devices, actuators, sensors or RF devices), reproducible growth of epitaxial films is necessary, which is still challenging due to the high volatility of Na and K. Growth of epitaxially strained (K,Na)NbO3 thin films on IKZ own oxide substrates will be discussed with regard to the impact of lattice strain on the ferro-/piezoelectric properties of the films. As application example, the propagation of surface acoustic waves and the use of thin films in biosensors are addressed.



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