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# AFM and HRTEM Morphology Studies of PZT Nanostructured Films

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Unless you can prepare unsupported films or low adhesivity film over supports, the morphology observation by TEM of nanostructured films can be very difficult because the problems of sample preparation.

Another options for sample preparation can consist on the scrapped of the film and milling it to obtain fine particles to be dispersed in alcohols and finally capillary adsorbed and deposited into the TEM greed support. In this case, the morphology would correspond to fine particulate agglomerates obtained by crushing the film microstructure.

In this work we show the results of morphology studies of PZT nanostructured films obtained using alternatively AFM and HRTEM techniques[1]. For that, PZT nanostructured films were prepared by ELD (electrolytic deposition)[2] over graphite substrates. The low adhesivity of the PZT film on the graphite substrate allowed us to obtain complete pieces of films with no damage in their nanostructure to be observed by HRTEM (Fig.1). Elemental distribution on the film was obtained by EELS mapping (Fig.2). HRTEM allowed us to observe the nanomorphology and also to determinate the PZT crystalline obtained phase: tetragonal perovsquite type phase ( fig.3). Figure 4 shows the Fourier transform of the high resolution zone in fig. 3. The ferroelectric domains of (010) planes were also observed (Fig.5). The use of AFM allowed to observe not only the nanostructure, composed by particles of 6nm mean diameter size, but also the morphology, the topography and the roughness of the nanostructured film (Fig.6), the highest zone of the obtained film was around 18nm.

References:
1.- Y. Cai, F. Philipp, A. Zimmermann, L.Zhou, F. Aldinger, M. Rühle Acta Materialia 51(2003)6429-6436.
2.- I. Espitia Cabrera, H. Orozco Hernández, R. Torres Sánchez, M.E. Contreras García, P. Bartola Pérez, L. Martínez Material Letters 58, (2003) 191-195.

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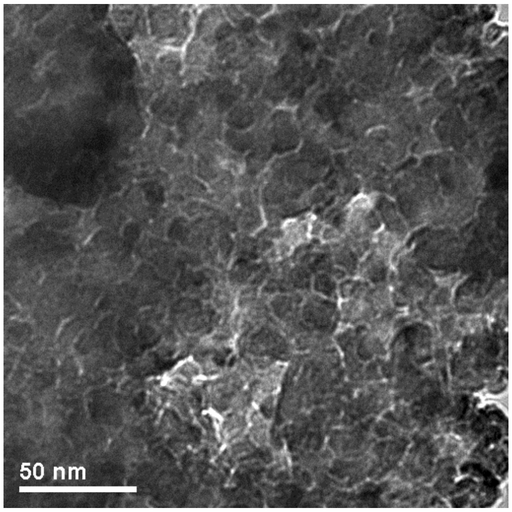


Fig. 1. Bright field TEM image of PZT film

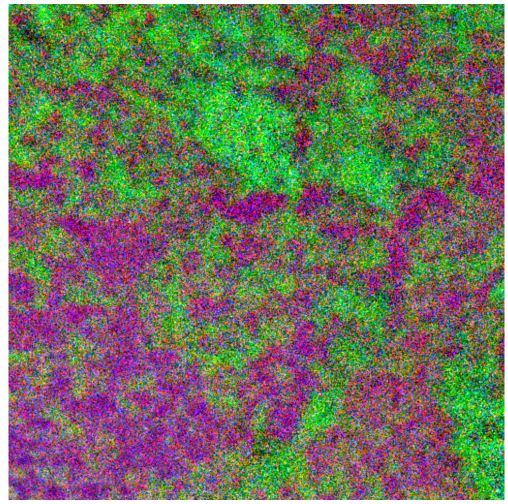

Fig. 2. EELS mapping of PZT film (Red=Pb, Green=Ti, Blue=Zr)

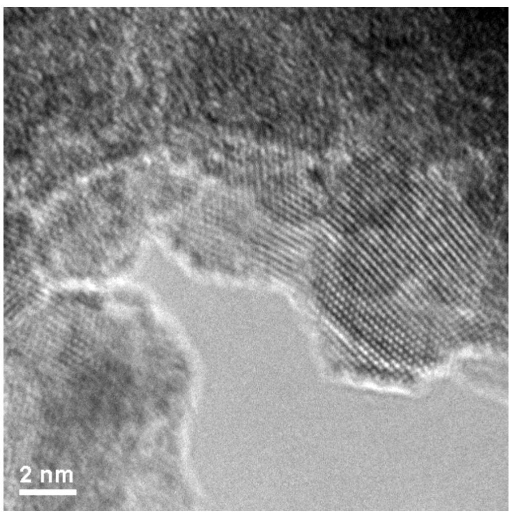


Fig. 3 HRTEM image of PZT film.

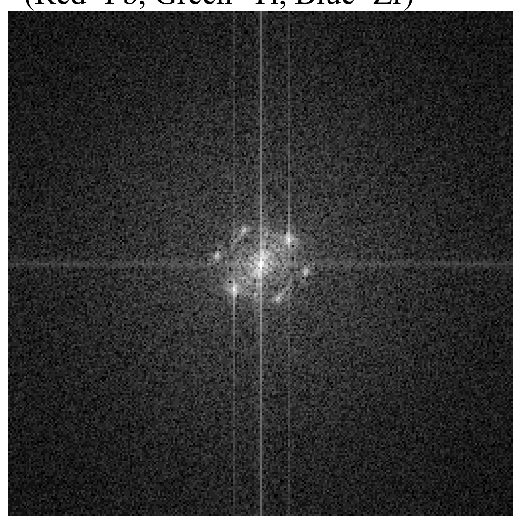

Fig. 4. FFT of PZT film

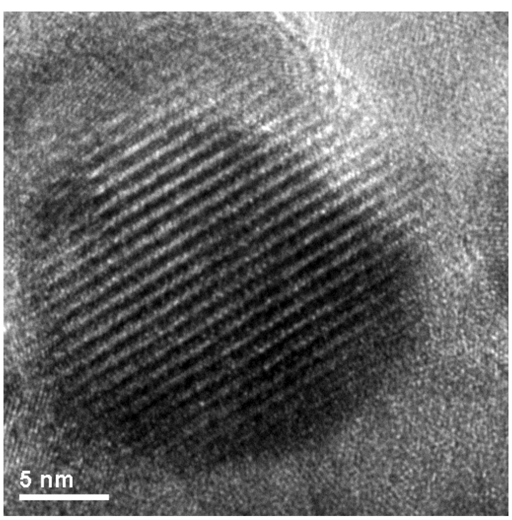


Fig.5. Ferroelectric domains on PZT film.

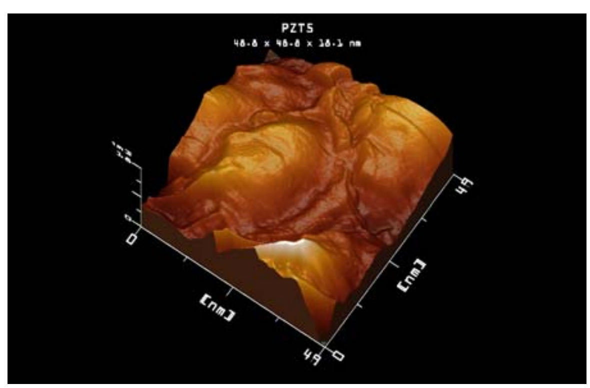


Fig6. AFM 3D image of PZT films

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