TEXTURED MPB $Pb(Mg_{1/3}Nb_{2/3})O_3$-$PbTiO_3$ CERAMICS FROM NANOCRYSTALLINE POWDERS: QUANTITATIVE ANALYSIS OF TEXTURE

H. Amorín[1], M. Algueró[1], J. Holc[2], M. Kosec[2], D. Chateigner[3] and J. Ricote[1]

1 Instituto de Ciencia de Materiales de Madrid, CSIC. C/ Sor Juana Inés de la Cruz 3 , 28049 Madrid, Spain

2 Jozef Stefan Institute. Jamova 39, 1000 Ljubljana, Slovenia

3 Laboratoire de Cristallographie et Sciences de Matériaux-ENSICAEN, IUT-Université de Caen Basse-Normandie, 6 Bd. M. Juin, 14050 Caen, France

e-mail: jricote@icmm.csic.es

We have proved the feasibility of a novel homogeneous-templated grain growth (TGG) approach for the processing of textured $Pb(Mg_{1/3}Nb_{2/3})O_3$-$PbTiO_3$ (PMN-PT) piezoceramics [1] through the study of their preferential orientations by the combined analysis of X-ray diffraction data. Texturing of PMN-PT ceramics at the morphotropic phase boundary (MPB) region has attracted a great deal of attention in recent years, due to the interest of obtaining piezoelectric coefficients comparable to those of single crystals [2]. In this work ⟨001⟩-textured ceramics of MPB PMN-PT are processed by homogeneous TGG of nanocrystalline powder with the use of cubic templates [3]. The process involves only conventional ceramic technology from a single source powder (Figure 1). Novelty rests on the use of a nanocrystalline powder obtained by mechanochemical activation for the matrix, and also for obtaining the templates by an exaggerated grain growth process.

The degree of preferential orientation achieved is usually evaluated by the Lotgering factor, which can be misleading [4], or by fitting rocking curves to the March-Dollase equation [5]. Even in this case, information is incomplete and referred only to specific crystallographic directions. In order to obtain quantitative and global information of texture in these ceramics, a combined analysis of the X ray diffraction pole figures (obtained with a four circle goniometer diffractometer) has been used [6]. The combination of advanced methods of analysis, the quantitative texture analysis and the Rietveld method, allows access to information on the different components of the global texture and to more accurate values of structural parameters, which are very relevant to understand

the behavior of these compositions at the MPB. The results obtained are compared with those that result of the use of more conventional methods of analysis of X ray data, and the feasibility of the application of the combined method to similar problems is discussed (Figure 2).

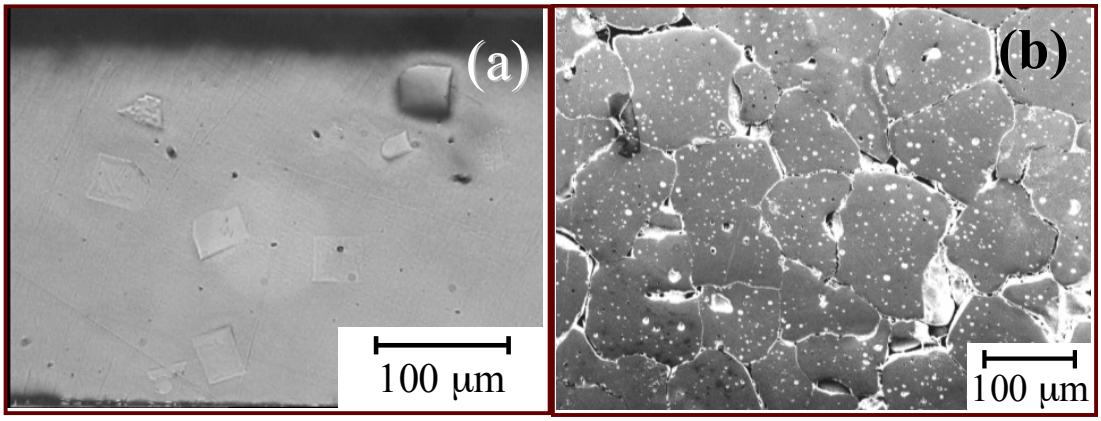

Figure 1. Optical micrograph of a PMN-PT ceramic:
a) before TGG showing the templates and b) after TGG [1].

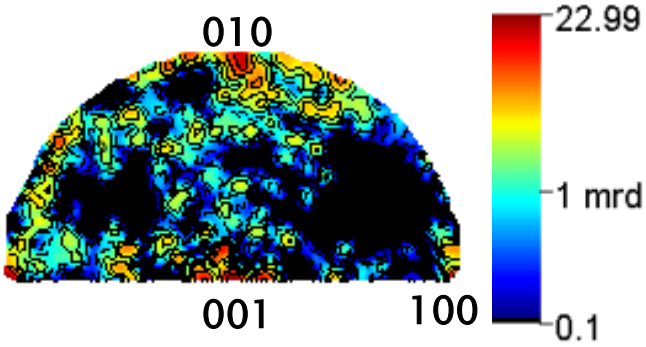

Figure 2. Inverse pole figure corresponding to the normal direction to the sample surface of a <001> oriented PMN-PT ceramic with a global texture strength F^2= 23 mrd^2 (equal area projection; logarithmic scale)

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