Processing of laminate ceramic composites based on the CoFe2O4/(K,Na)NbO3 system for study magnetoelectric effect

Washington S. Rosa[1*#], Michel Venet[1], Jean Claude M'Peko[2], Miguel Algueró[3], Harvey Amorín[3], Rodrigo Moreno[4]

[1]Departamento de Física, Universidade Federal de São Carlos (UFSCar), 13565-905 São Carlos, SP, Brazil
[2]Instituto de Física de São Carlos, Universidade São Paulo (IFSC-USP), 13563-120 São Carlos, SP, Brazil
[3]Instituto de Ciencia de Materiales de Madrid (ICMM), CSIC, Cantoblanco, 28049 Madrid, Spain
[4]Instituto de Cerámica y Vidrio (ICV), CSIC, Kelsen 5, 28049 Madrid, Spain

[#]Corresponding author: washington@df.ufscar.br

Materials with a coexistence of magnetic and ferroelectric order (i.e. multiferroics) provide an efficient route for the control of electric polarization by magnetic fields. The study of multiferroics materials is now advancing at a rapid pace. There has been progress in the understanding of the behavior of magnetoelectric (ME), especially on the coupling control of its responses. [1,2] The general focus of the field is now shifting towards design composite materials, which consists of a ferroelectric (for its piezoelectric property) and a ferro-or ferrimagnet (for its magnetostrictive property).[3] The largest values of the ME effect have been achieved in composites containing excellent piezoelectrics such as lead zirconium titanate (PZT)-based composites [e.g., Pb(Zr,Ti)O3]. However, restrictions on using lead in electronic equipment have motivated search for lead-free alternatives. A very promising material is (K,Na)NbO3 (KNN), and very good piezoelectric coefficients d_{33} have been found for specific chemical modifications [3].

Here, we report results on the processing of magnetoelectric laminate ceramic composites based on the CoFe2O4/(K,Na)NbO3 system. Both three-layer and multilayer structures prepared by either conventional forming procedures or tape casting have been obtained and characterized. Emphasis is put on the relationships between the processing parameters and the functional magnetoelectric response.

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