Magnetoelectric Coupling in $BaTiO_3:Fe_{(113ppm)}$

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Abstract

The Multiferroic field of research is a very interesting and promising, mainly the research regarding the Magnetoelectric effect, a coupling between the material ferroelectric and magnetic properties which has a huge technological potential [1-2]. Such as the possibility of having ultrafast memories where the data is written electrically but is read magnetically, or the possibility of having 4 different possible states to use as bits (figure 1) instead of the usual 2 are two direct applications that could be possible once the Magnetoelectric effect is well controlled [3-4].

Due to the scarcity of intrinsic Magnetoelectric materials many type of composites where suggested made of typical ferroelectric and typical ferromagnetic materials [5-6]. The usual suspects are the Barium Titanate as a ferroelectric and Iron as a ferromagnetic. So far, many studies using high concentrations of Fe in the BTO matrix [7-8] did not show the intended Magnetoelectric effect.

This poster shows a study made in BTO containing about 113 ppm of Fe atoms (originating from the reactants impurities) where it was possible to measure a positive susceptibility and an abrupt variation of magnetization around the electric phase transitions of the BTO (figure 2). This surprising behavior can be explained by a highly diluted nanometric phase of Iron oxide, segregated and growing epitaxially on the BTO grains, which shows a relevant Magnetoelectric effect and can be seen as an interesting principle of the use of ME probe [9].

References

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Figures

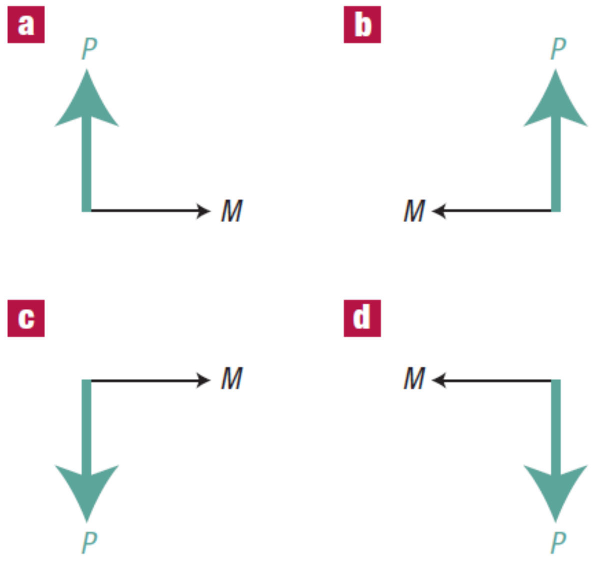

Figure 1 -The 4 different states possible for the Magnetoelectric coupling: (+P,+M), (+P,-M), (-P,+M) and (-P,-M) (ordered from a to d) [4]

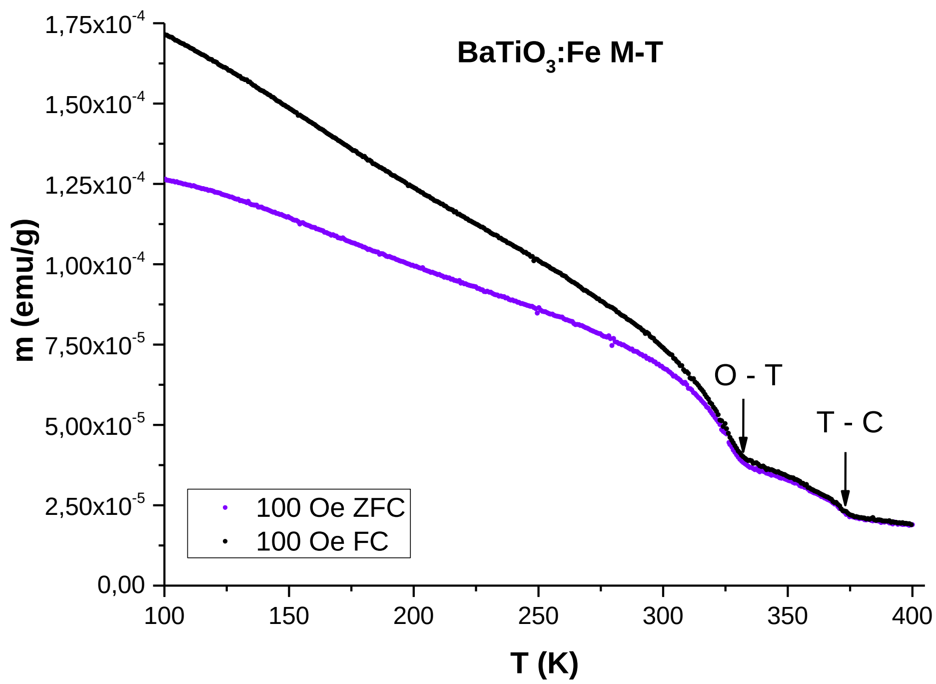

Figure 2 – Magnetization curve of BaTiO3:Fe measured in the IFIMUP SQUID