Reduction of PbO loss in PZT-cobalt ferrite composites through quite-fast sintering and its quantification by means of XRD analysis

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**ABSTRACT**

In the near future (within ten years) magnetoelectric multiferroics could be implemented into the emerging technologies such as wireless power, internet of things, machine-to-machine communication services, mesh network, etc. A great research effort is in progress to improve the fabrication of PZT–CoFe₂O₄ (PZT–CF) composites due to the excellent piezoelectric properties showed by the PZT material class and the large magnetostrictive coefficient of the CF. Unfortunately, during the sintering process of the particulate PZT-CF composites, side reactions do occur that are detrimental to the properties of the so-obtained material.

In this study:
1. we have avoided such reactions and PbO loss by setting a quite-fast sintering process.
2. The extent of PbO loss was determined by means of XRD analysis of the densified samples taking into account the amount of ZrO₂ and the variations of the perovskite's tetragonality.

**EXPERIMENTAL**

**RESULTS**

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Pietro GALIZIA, Claudio CAPIANI, Carmen GALASSI
CNR-ISTEC, Istituto di Scienza e Tecnologia dei Materiali Ceramici, Via Granarolo 64, I-48018 Faenza, ITALY
pietro.galizia@istec.cnr.it

Appendix: how to calculate the PbO loss (δ) through XRD analysis

Supposed reaction due to the PbO loss:

\[
Pb(Zr_{0.52}Ti_{0.48})O_3 \rightarrow f \cdot PbO(g) + (1-f) \cdot Pb(Zr_{0.52}Ti_{0.48})O_3 + 0.52(1-f+y) \cdot ZrO_2 + 0.48(1-y+f) \cdot TiO_2
\]

where \(m_{Pb}\) and \(m_{Zr}\) are the stoichiometric coefficients of lead and zirconium in the starting perovskite phase, respectively. In our case, \(m_{Pb} = 1\) and \(m_{Zr} = 0.52\).

**CONCLUSIONS**

For the first time fully dense particulate PZT-CF composites were produced by quite fast sintering. Full densification and suppression of chemical reactions are required to improve the magnetoelectric coupling.

You can find further results, about the microstructure evolution, chemical reaction, and functional properties, in the papers [1, 2].

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References