

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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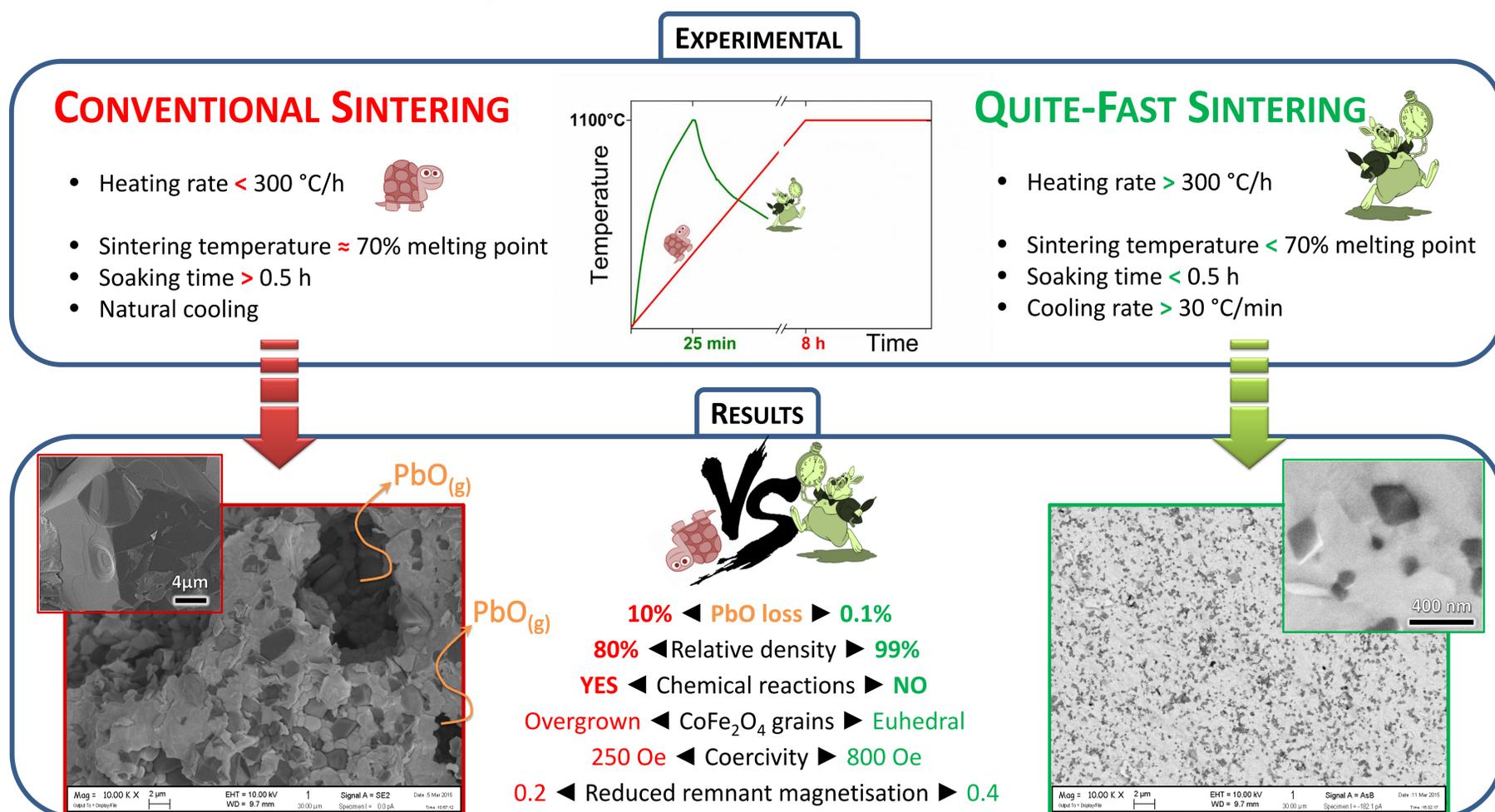
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ABSTRACT

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.



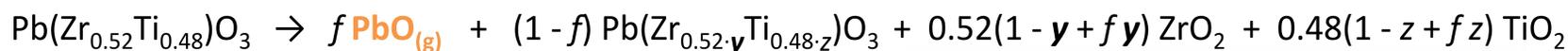
CONCLUSIONS

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].

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

Supposed reaction due to the PbO loss:

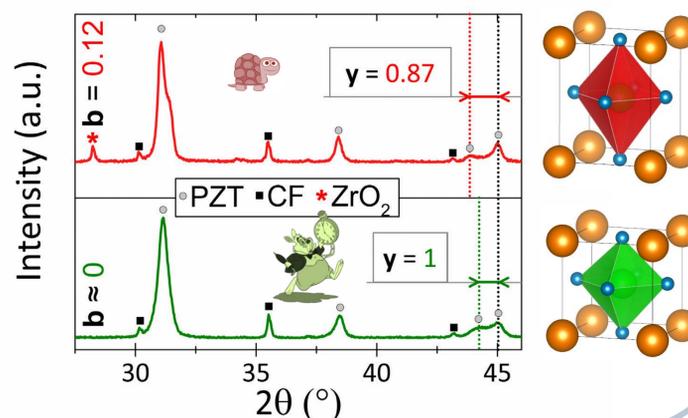


Once ZrO₂ molar fraction (b) and the change of the amount of Zr in the produced perovskite (y) has been quantified by quantitative XRD analysis, PbO loss can be calculated through the following equation [1]:

$$\delta = m_{\text{Pb}}(b/m_{\text{Zr}} - 1 + y)/y$$

← Proposed equation!

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



Acknowledgements

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References

- [1] PZT-cobalt ferrite particulate composites: Densification and lead loss controlled by quite-fast sintering. *J Eur Ceram Soc* **37**:1 (2017) 161-168
- [2] Multiple parallel twinning overgrowth in nanostructured dense cobalt ferrite. *Mater Design* **109** (2016) 19-26