

DENSIFICATION OF CLASSIC AND FRAGILE FERROELECTRICS BY COOL-SPS

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Key Words: Cool-SPS, low temperature sintering, fragile materials, dense ceramics, classic ferroics

This presentation will illustrate the investigation by Cool-SPS (Spark Plasma Sintering) of the sintering of fragile ferroelectric materials. The efficiency of this advanced technique to sinter, stabilize or even synthesize fragile materials has been established by previous studies conducted at ICMCB [1,2].

Fragile materials have a limited thermodynamic stability that prevents their conventional sintering, i.e. pressureless densification at high temperature ($T > 1000^{\circ}\text{C}$). However, the characterization and use of ferroelectric materials require dense samples. An access to the ceramic form for fragile ferroelectrics could allow avoiding the difficulties inherent to the elaboration and characterization of thin films or single-crystals. In this presentation, it will be shown that Cool-SPS can be used to obtain highly densified ceramics of classic ferroic materials such as Rochelle salts, KDP, etc. Dense ceramics of such fragile ferroelectrics were obtained in less than 2 hours at low temperature ($< 200^{\circ}\text{C}$). As these classic ferroics have been studied for decades in single-crystal form, their successful sintering offers an opportunity to investigate their ferroic properties in polycrystalline form. The structure and micro-structure of the obtained ceramics will also be presented. Moreover, with previous reports concerning the sintering of KDP (and also proton conductor CsH_2PO_4 [3]) by CSP (Cold Sintering Process), advantage will be taken of the opportunity to compare both approaches and highlight their complementarity.

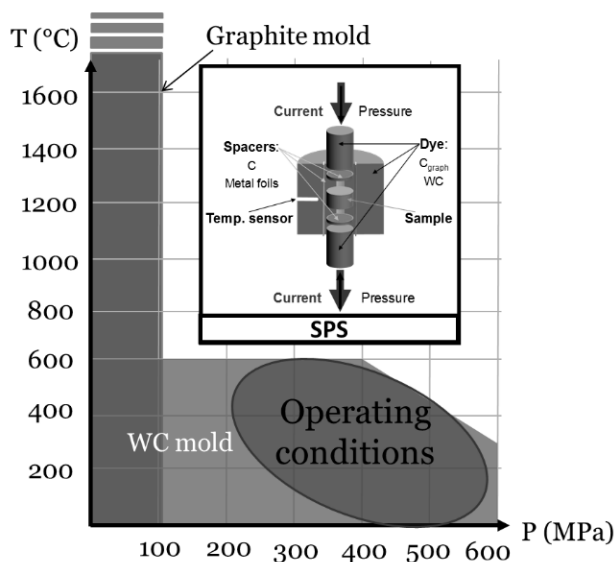


Figure 1 – Cool-SPS operating conditions used to sinter fragile materials.

- [1] T. Hérisson de Beauvoir, A. Sangregorio, I. Cornu, C. Elissalde, and M. Josse, *J. Mater. Chem. C* 6, 2229 (2018).
- [2] T. Hérisson de Beauvoir, F. Molinari, U. C. Chung-Seu, D. Michau, D. Denux, and M. Josse, *J. Eur. Ceram. Soc.* 38, 3867 (2018).
- [3] H. Nakaya, M. Iwasaki, T. Hérisson de Beauvoir, and C. A. Randall, *J. Eur. Ceram. Soc.* 39, 396 (2019)