**AC VS. DC FLASH SINTERING: INFLUENCE OF FIELD FREQUENCY ON FLASH PROCESSES**

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Directional field phenomena such as electrochemical reduction and temperature gradients are common when performing Flash Sintering (FS) experiments under DC fields [1]. The use of AC fields has been suggested instead to minimize these issues, allowing for finer grain sizes and microstructural homogeneity [2]. However, the effect of the electric field frequency on the onset temperature and overall conductivity evolution during the flash process remains controversial. The present work aims to clarify the influence of alternating fields over a wide frequency range on the flash-onset. For a model ionic conductor such as 8-mol% Yttria-Stabilized $ZrO_2$ (8YSZ), the flash-onset depends on the frequency up to 50 Hz while no further effect of frequency is found up to 50 kHz (Figure 1). Conversely, results for $BiFeO_3$ (BFO) show no significant differences between DC and AC fields because of its mainly electronic conduction. The electrical conductivity of 8YSZ during the flash experiments depicts a non-linear landscape with two distinct regions, prior and after the flash-onset. A noticeable decrease in the activation energy can be explained as an increase in the concentration and/or mobility of ionic charge carriers but also as a sign of electronic conduction. Moreover, the frequency dependence of activation energy could indicate that frequency has an effect on balancing the ionic and electronic contributions in the likely scenario of mixed conduction in 8YSZ flash. Activation energy changes for BFO were not as significant.

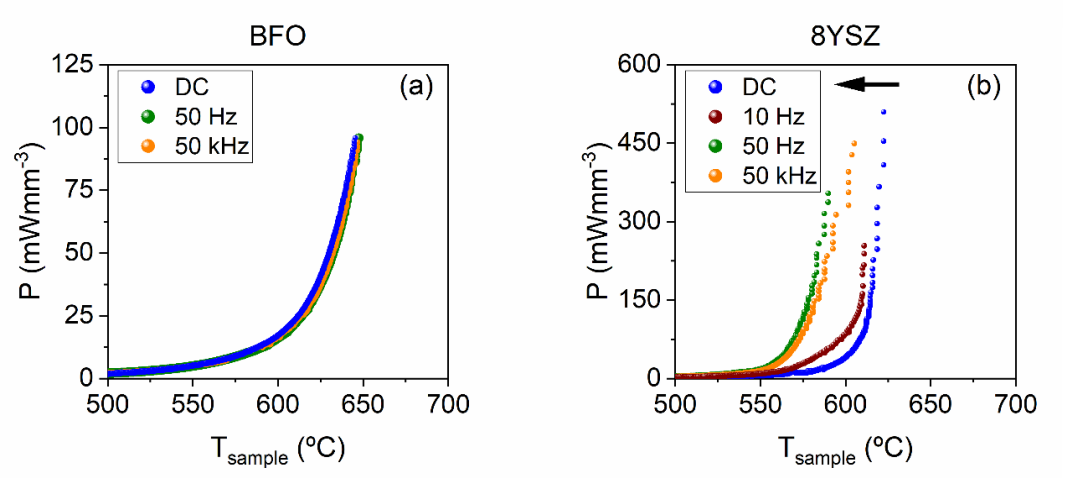


*Figure 1: Dissipated power density against temperature profiles recorded during flash experiments of (a) BFO and (b) 8YSZ. The arrow points the shift towards lower temperatures of the 8YSZ profiles as the frequency increases.*

References

[1] S. Molina, P.E. Sánchez-Jiménez, A. Perejón, Luis A. Pérez-Maqueda. Electrode effects on microstructure formation during flash sintering of yttrium-stabilized zirconia. Ceram. Int. In press (2023).
[2] X.L. Phuah, B. Yang, H. Charalambous, T. Tsakalakos, X. Zhang, H. Wang, Microstructure and defect gradients in DC and AC flash sintered ZnO, Ceram. Int. 47 (2021) 28596–28602