Minicolloque CPR25 ⊗ **Oral** ☐ **Poster**

Structural defects in fine-grained $MgAl_2O_4$ sintered ceramics through the elaboration process: from the powder to the post-densification treatment

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Compounds with the spinel structure AB_2X_4 have been predicted to exhibit high tolerance to ionizing irradiation, due to low energy formation of structural defects such as F-centers (anionic vacancies), V-centers (cationic vacancies), antisite defects and their combinations [1]. Between them, $MgAl_2O_4$ is considered for extensive optic applications as a radiation tolerant material stable in extreme environments [2]. High-density of grain boundaries in the bulk ceramic is required for the effective capture and recombination of defects induced by ionizing radiation, providing an improved material functionality [3]. The relevant $MgAl_2O_4$ ceramics have to possess high mass density and small grain size at the nanoscale. In this context, the understanding of their electronic band structure and defects induced by the elaboration of spinel ceramics is mandatory.

In this work, we investigated the structural defects contained in fine-grained magnesium aluminate spinel ceramics obtained by spark plasma sintering, as well as their influence on optical and magnetic properties. We studied the evolution of these defects at each steps of the elaboration process (raw powder, SPSed ceramics and after heat treatments) for a better understanding of their nature, their stability and their eventual conversion. We also investigated the effect of Ta-doping. The microstructural and crystallographic properties were characterized by SEM and XRD, the structural defects by photoluminescence (PL) and Electron Paramagnetic Resonance (EPR), and the static magnetic properties by SQUID. The Figure 1 shows the impact of the sintering process on the EPR signals, revealing the emergence of new paramagnetic defects depending on the sintering treatment and structural properties.

[1] K. Sickafus, Science **289**, 5480 (2000)
[2] A. Lushchik, Sci. Rep. **10**, 7810 (2020)
[3] G. Ackland, Science **327**, 1587 (2010)

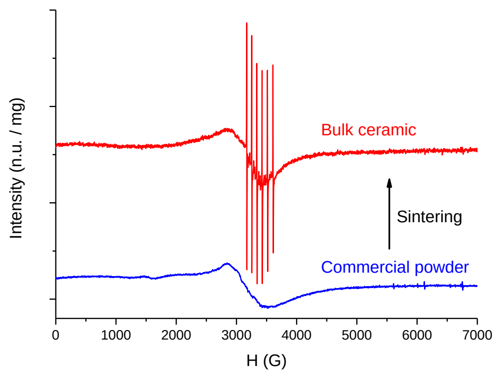

Figure 1 : Electron Paramagnetic Resonance (EPR) first derivative signals for the used commercial powder (blue curve) and for the bulk ceramic after Spark Plasma Sintering (red curve)