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Václav Tyrpekl[1], Adam Alemayehu[1], Dominika Zákutná[1], Marco Cologna[2], Daniel N. Rainer[1]

[1]Faculty of Science, Charles University, Prague, Czech Republic
[2]European Commission, Joint Research Centre (JRC), Karlsruhe, Germany

IN-SITU GENERATION AND GRAIN GROWTH OF CeO_2 NANOCRYSTALS IN AC/DC ELECTRICAL FIELDS

We have performed a set of grain growth tests in AC, DC and no electrical field. We used crystalline cerium(III) oxalate, which gives upon heating (300 °C) nanocrystals of CeO_2. A pellet of cerium oxalate was decomposed in between two platinum electrodes (no current passing) with/without applied AC/DC electrical field. Therefore, the nanocrystals of CeO_2 were in situ generated under the electrical field and later grown by increasing temperature. The heating and field application was cut at desired temperature (400-1000 °C with 50 °C step). We have compared the grain growth and other characteristics (grain size, preferred orientation, strain, strain distribution etc.) for no field, AC field (50Hz), and DC. The electric fields applied were > 800V/cm. Figure 1 shows grain size and strain analysis for experiments done in AC field. We have found that the electric field has significant effect on the grain size, texture and strain, especially at low temperatures, when the thermally driven diffusion is plays minor role. In the case of CeO_2 the loss of electrical field effect is about 600 °C.

Key Words: Grain growth, ceria, morphology, AC/DC fields

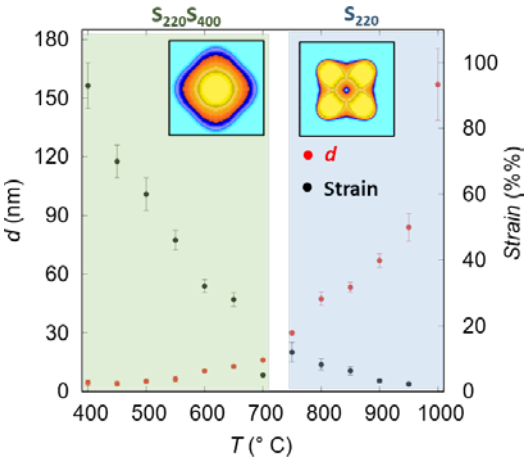

Figure 1 – Grain size and strain for CeO_2 treated at different temperature under AC electrical field. Strain distributions inside the crystallites is presented in the top part, strain texture is noted by color.

*corresponding author: e-mail: vaclav.tyrpekl@natur.cuni.cz