

# ELECTROCHEMICAL, OPTICAL AND THERMAL EFFECTS DURING FLASH SINTERING OF 8YSZ

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We report on the electrochemical effects occurring during the flash sintering of 8YSZ. In-situ observations for both polycrystalline and single crystal specimens confirm electrochemical blackening/darkening during the incubation period prior to flash sintering (Figure1), even though chromatic alterations are usually visible only after the samples are cooled down in a protective atmosphere rather than in air. The phenomenon is induced by cathodic partial reduction under a DC field. When using a low frequency AC (square 0.1 – 10 Hz) field, the blackening becomes reversible and it follows the imposed polarity switching. Thermal imaging combined with sample color changes (transparent single crystals) and electrical conductivity mapping give a complete picture of the multi-physical phenomena occurring during each stage of the flash sintering event.

The partial reduction causes a modification of the electrical properties in the samples, the blackened regions (close to the cathode) are more conductive than the rest of the sample. The asymmetrical nature of the electrochemical reduction follows the field polarity causing asymmetry of temperature from anode to cathode where the positive electrode tends to overheat. The phenomena are governed by the quality of electrical contacts and treating atmosphere.

*Figure 1 – Color change during flash sintering of 8YSZ single crystal.*

