

Winter 3-8-2016

# Estimating ionic conductivity during flash sintering of $\delta$ ysz

Daniel Marinha

*Saint-Gobain CREE*, [daniel.marinha@saint-gobain.com](mailto:daniel.marinha@saint-gobain.com)

Follow this and additional works at: [http://dc.engconfintl.org/efa\\_sintering](http://dc.engconfintl.org/efa_sintering)



Part of the [Engineering Commons](#)

---

## Recommended Citation

Daniel Marinha, "Estimating ionic conductivity during flash sintering of  $\delta$ ysz" in "Electric Field Assisted Sintering and Related Phenomena Far From Equilibrium", Rishi Raj (University of Colorado at Boulder, USA) Thomas Tsakalakos (Rutgers University, USA) Eds, ECI Symposium Series, (2016). [http://dc.engconfintl.org/efa\\_sintering/23](http://dc.engconfintl.org/efa_sintering/23)

This Abstract is brought to you for free and open access by the Proceedings at ECI Digital Archives. It has been accepted for inclusion in Electric Field Assisted Sintering and Related Phenomena Far From Equilibrium by an authorized administrator of ECI Digital Archives. For more information, please contact [franco@bepress.com](mailto:franco@bepress.com).

## ESTIMATING IONIC CONDUCTIVITY DURING FLASH SINTERING OF 8YSZ

Daniel Marinha, Saint-Gobain CREE  
daniel.marinha@saint-gobain.com  
Yaxi Du, Saint-Gobain CREE  
Adam Stevenson, Saint-Gobain CREE

Key Words: flash sintering, sintering, YSZ, zirconia, current-assisted, FAST.

We provide evidence for temperature-driven flash sintering process, accounting for otherwise interpreted as abnormal behavior. Using 8%-Yttria-doped Zirconia as reference material, we selected moderate flash conditions to avoid external current-limiting control. Samples were dry-pressed and pre-sintered to relative densities between 50 and 85 %TD by interrupting sintering at pre-determined shrinkage values, in conventional and flash sintering processes. SEM characterization shows similar trends for average grain size, porosity levels and distribution between flash and conventional samples. Bulk and grain boundary conductivity and characteristic frequencies, measured by impedance spectroscopy, show similar behavior regardless of the processing route.

A third series of samples were pre-sintered and then flash sintered. The conductivity was measured as a function of relative density for different temperatures. These data were used to derive a scaling-law for flash sintering, which expresses sample conductivity versus temperature, corrected for instantaneous density. It replicates the signature current runaway during flash sintering which has been associated with unconventional sintering mechanisms.

We conclude instead that it derives simply from the interdependence of conductivity with densification and sample self-heating through joule effect. A rough estimate of sample temperature can convert this non-linearity to a well-known Arrhenius behavior. Results apply equally well to previously published data, both in isothermal or constant heating conditions.

