Winter 3-7-2016

Electrical conduction mechanism at high voltages and dielectric breakdown strength in bulk ceramic insulators

Gerold Schneider
Hamburg University of Technology

Claudia Neusel
Hamburg University of Technology

Follow this and additional works at: http://dc.engconfintl.org/efa_sintering

Part of the Engineering Commons

Recommended Citation

Gerold Schneider and Claudia Neusel, "Electrical conduction mechanism at high voltages and dielectric breakdown strength in bulk ceramic insulators" 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/9

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.
Electrical conduction mechanism at high voltages and dielectric breakdown strength in bulk ceramic insulators

Gerold A. Schneider, Claudia Neusel

Electrical conductivity at high electric fields and dielectric breakdown of bulk ceramic insulators is not well understood. In order to gain more insight we performed current-voltage measurements on different ceramics to identify whether ohmic, space charge limited, Schottky, or Poole-Frenkel conduction, is the dominating conduction mechanism. Voltages up to 70 kV were applied and revealed that space charge limited conduction (SCLC) prevails at high electric fields in all investigated ceramics. As SCLC is a size dependent phenomenon the transition from ohmic to SCLC was determined as a function of the thickness of the disc-shaped samples. As a consequence electric field assisted sintering or breakdown models based on ohmic conduction must be critically regarded whether they can be applied. In a second part of this presentation we present the dielectric breakdown strength of these ceramics as a function of the sample thickness. It turns out that besides the well-known inverse square root dependence of the sample thickness there is also an inverse square root permittivity dependence of the dielectric breakdown strength. A Griffith type energy release rate dielectric breakdown model based on SCLC is presented, which is able to describe the size and permittivity dependence of dielectric breakdown.