FLASH SINTERING OF INJECTION MOLDED ZIRCONIA UNDER AC ELECTRIC FIELD FOR ENHANCEMENT OF OPTICAL PROPERTIES

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Zirconia is a very versatile ceramic material used in many applications, from structural components to healthcare implantable parts. The majority of current flash research has been performed using uniaxial pressed samples. In our research, we looked to study a large-scale manufacturing technique to produce the samples to be sintered. Ceramic injection molding (CIM) is a known method to produce complex shaped parts with great precision and high density. The high binder content in CIM parts can cause difficulty during flash sintering, due to the high porosity left after debinding process. This can cause localization and flashover during the application of the electric field. Commercially injection molded partially stabilized zirconia (3YSZ) was chosen as it has important properties, such high fracture toughness, however, it is usually opaque due to inherent microstructure defects and grain size of the material. For many applications, zirconia, does not require a particular color or specific appearance, but in some cases for aesthetic uses, a transparent-like material is highly desirable. This paper will describe the results on flash sintering equipment design and field parameters used in order to optimize levels of translucency in zirconia disks, with high fracture toughness. The flash sintering process is shown to be repeatable, and is compared with conventionally sintered samples to assess the improvement on translucency and/or fracture toughness. It is then proposed that flash sintering is an enabling mechanism for the use of zirconia in a wider range of applications and markets, where aesthetics and toughness are required in parallel.