MICROWAVE CRYSTALLIZATION OF LITHIUM DISILICATE GLASS

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The technological progress is not possible without the discovery of new materials and new processing techniques. Although microwave processing is well established and used extensively in many areas of materials processing, the exact mechanisms and effects, "thermal or non-thermal," through which the microwaves interact with materials is not well understood. It has been shown in previous studies that glass can be converted into glass-ceramics by microwave energy, but the mechanism of both nucleation and crystallization has not been studied in detail. The main goal for this study is to understand the crystallization mechanism and kinetics of the glass crystallized by fixed frequency, multimode microwave energy.

Twenty (20) rods of lithium disilicate (in mole %: $LiO_2 \cdot 2SiO_2$) glass samples have been prepared from lithium disilicate glass frit (Specialty Glass Inc., Florida). This glass system provides the basis for a large number of glass-ceramic products, such as cookware, radomes, ceramic composites, stovetops and dental crowns. The crystallization kinetics and microstructure of this system have been well-studied with respect to conventional heating. Glass samples were cast and annealed. Characterization of the prepared glass and glass-ceramics samples was conducted using Fourier Transform Infrared Spectroscopy (FTIR), X-ray diffraction (XRD), optical microscopy, scanning electron microscopy (SEM) and pycnometry. Differential thermal analysis was done for the glass samples to determine the nucleation (T_n) and crystallization temperatures (T_C). Nucleation was carried out in a tube furnace. The nucleated samples were subjected to a careful crystal growth schedule in order to convert the nucleated glass into glass ceramics material by conventional and microwave heating (fixed and variable frequency). A comparison between crystallization kinetics of glass ceramics materials produced by conventional heating and microwave energy at the crystal growth stage was conducted.