

Glass-ceramic materials

Structural Materials Group
at DCM/FCT/UNL and CENIMAT/I3N



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- Chemistry degree, FC/UL, 1976
- PhD in ceramics and glasses, University of Sheffield U.K., 1981
- Current Research Interests: Ceramic materials, glasses, glass-ceramics, glass matrix composites with ceramic fillers.

Objectives

Different projects are being developed involving the synthesis and characterization of glass-ceramics and composites of glass matrix based on different ceramic oxide systems. The objectives are:

- To produce glass-ceramics and glass-ceramic nanoparticles composites with adequate thermal, electrical and dielectric properties to be used as electronic devices such as substrates and display panels.
- To produce glass-ceramics with high mechanical strength, high hardness and high chemical durability to be applied as biomaterials, for example in dental restoration.

Methodology

Synthesis of glass-ceramics by controlled heat treatment of bulk glasses and by controlled sintering and crystallization of glass powders.

Structural characterization by X-ray diffraction (XRD) and differential scanning calorimetry (DSC). Microstructural characterization by scanning electron microscopy (SEM).

Characterization of the thermal expansion coefficient, electrical and dielectric properties of the glass-ceramics and of the composites.

Characterization of the flexural strength, fracture toughness, hardness and chemical resistance of the glass-ceramics and of the composites.

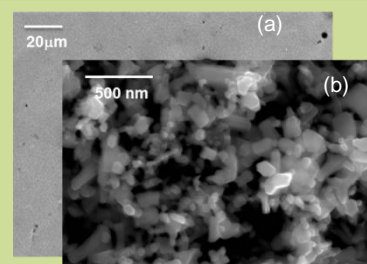
Expected Results

To obtain glass-ceramic materials with a tailored microstructure that exhibit enhanced properties relatively to the starting glasses.

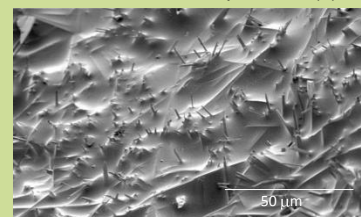
To study the kinetics of glass crystallization and to understand the nucleation and crystallization mechanisms of the glasses.

To study the influence of the ceramic filler additions on the crystallization and sintering of the glass

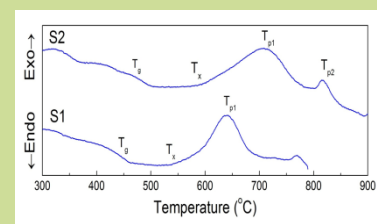
To study the influence of glass composition and of heat treatment conditions on the final properties of the processed glass-ceramics and composites.



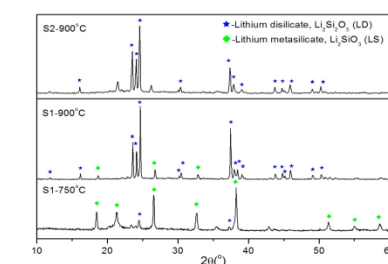
SEM of glass-ceramic (a) and of ceramic nanoparticles (b)



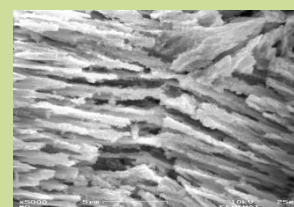
SEM of a glass matrix composite with ceramic fibres



DSC curves for glasses



XRD patterns for glass-ceramics



SEM of a glass-ceramic for dental restoration

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