
Transparent oxyfluoride nano-glass ceramics: Processing is the key

Alicia Duran*¹

¹Alicia Duran (CSIC) – Instituto de Ceramica y Vidrio (CSIC), Kelsen 5, Campus de Cantoblanco, Spain

Abstract

Transparent oxyfluoride glass-ceramics (OxFGCs) have attracted great interest in the field of photonics since the pioneering work of Wang and Ohwaki. Alumina-silicate glass matrices are particularly suitable for their excellent mechanical, thermal and chemical properties compared to phosphate or fluoride glasses. On the other hand, fluoride crystals, especially those containing Ln³⁺ ions, are especially good hosts for their low phonon energy and offer high solubility of Rare-Earth (RE) ions. The classical processing route to obtain transparent OxGFCs consists on a controlled crystallization of the precursor glass obtained by melt-quenching (MQ). Bulk materials and fibers have been obtained by this method although this processing route faces the problem of the high melting temperatures that cause a fluorine loss, limiting the final crystal content to less than 10 wt%.

On the other hand, the sol-gel process is a suitable alternative to prepare OxGFCs materials due to the low synthesis and sintering temperatures involved, thus allowing the preparation of novel compositions, especially as thin films, with higher crystal content up to 30 wt%.

In this work we will show the results, obtained in the last ten years, for bulk, optical fibers and thin films produced by MQ, sol-gel and fibering. In particular, the relationship between processing, structure and improved optical properties will be discussed focusing on the superior optical properties of these materials as compared to the precursor glasses.

Keywords: glass, ceramics, processing, sol, gel, optical properties, oxyfluorides

*Speaker