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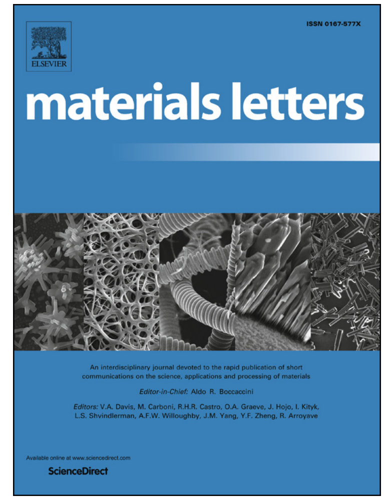

Fluorapatite-glass-ceramics obtained by heat treatment of a gel synthesized by the sol-gel processing method

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Fluorapatite-glass-ceramics obtained by heat treatment of a gel synthesized by the sol-gel processing method

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Abstract:

A new fluorapatite-glass-ceramic was processed from sol-gel by controlling the heat treatment. The obtained results seemed to confirm the nucleation and growth of fluorapatite nano-phase in the glass. In addition, some mechanical properties of the new fluorapatite-glass-ceramic such as rupture strength and elastic modulus and shear modulus were measured and their obtained values were σ_r*=27±2MPa, E=20±0.3GPa and G=7.7±0.1GPa, respectively. This glass-ceramic can have promising applications in dental prostheses because it would release fluoride ions, which can be an effective protector against dental caries.*

Keywords*: sol-gel, glass-ceramic, fluorapatite.*

1. Introduction

Glass can be made using traditional melt-quenching or sol-gel processes. The latter essentially forms and assembles nanoparticles of silica at room temperature [1]. The major difference between melt-quenching and sol-gel-derived glasses is nanoporosity [2]. This nanoporsity, in sol-gel-derived glasses, increases their solubility, which is important for bioactivity [3]. Bioceramics and bioactive glasses are required as biomaterials for reconstitution of bone defect in orthopaedic maxillofacial and dental applications [4-8].

Among bioceramics, fluorapatite (Fap) was considered as a good choice for biomedical purposes and for scaffold construction in bone and teeth tissue engineering [9]. However, to our knowledge, materials design has not yet succeeded in creating a bioactive glass encompassing the advantages of Fap.

The purpose of this study was to report on the synthesis of a new fluoropatite-glass-ceramic that would release fluoride ions. Then, it characterized its physicochemical and the mechanical properties to determine its possible uses as an implant material.

2. Materials and Methods

The preparation of the 77S gel *(77* SiO_2*-14 CaO-9* P_2O_5 *in wt.%)* involved hydrolysis and polycondensation reactions of tetraethyl orthosilicate (TEOS, $Si(OC_2H_5)_4$; Sigma-Aldrich, pureness ≥ 99,8%), triethyl phosphate (TEP, $OP(OC_2H_5)_3$; Sigma-Aldrich, pureness ≥ 99%), calcium nitrate ($Ca(NO_3)_2$, 4 H_2O; Sigma-Aldrich,