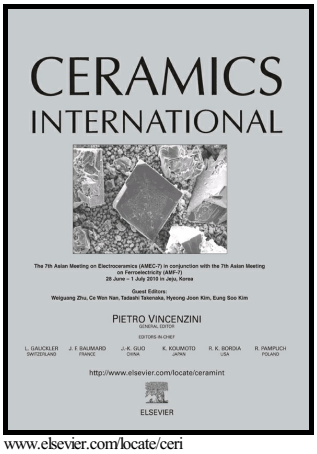

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Bioactivity and antibacterial activity against E-coli of calcium-phosphate-based glasses: effect of silver content and crystallinity

M.N. Capela[a], D.M. Tobaldi[a], C. Oliveira[b], A. Pereira[b], A.S. Duarte[b], M.P. Seabra[a], M.H.V. Fernandes[a]

[a] *Department of Materials and Ceramic Engineering/CICECO - Aveiro Institute of Materials, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal.*
[b] *Department of Biology & CESAM, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal.*

Abstract

In this work we developed improved bioactive glasses and glass-ceramics for biomedical applications, investigating their *in vitro* bioactivity, biocompatibility and antibacterial properties against *E-Coli*. A melt-quenched bioactive glass of the SiO_2-CaO-P_2O_5-MgO system was modified with the addition of 1 and 2 mol% Ag_2O and the 1 mol% Ag_2O-containing glasses were then heat treated to produce glass-ceramics. Surface modifications after soaking in SBF and ionic concentration changes showed that addition of silver and crystallization did not affect bioactivity although crystalline phases promoted a decrease in the degradation rate.

Biocompatibility of all Ag-containing glasses and glass-ceramics was confirmed for certain samples concentrations. The antibacterial activity of the glasses against *E-Coli* was generally improved with decreasing particle size or increasing Ag_2O. The Ag-containing glass-ceramics with higher content of crystalline phase appears as a promising biocompatible biocidal material with potential applications in bone-related diseases.

Keywords: Glass; Glass-ceramic; Bioactive; Silver; Antibacterial

1. Introduction

Since the discovery of Bioglass® by Hench [1] this material and its derivatives have been widely investigated for different biomedical applications [1,2]. This bioactive glass (BG) was the first to show the formation of an interfacial bond with the host bone tissue without encapsulation by fibrous tissue after implantation [1-3]. Bioactive glasses (BGs) with compositions based on silicate (such as Bioglass®), phosphate [2,4] or borate systems [2] can be produced by the melt-quenching route or by the sol-gel process [2,5,6]. These biomaterials show osteogenic properties and ability to bond to soft and hard tissues by means of a carbonated hydroxyapatite (HCA) layer [2,4] with composition and structure similar to those of bone mineral [2] even when exposed to an *ex vivo* biological fluid.