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Effect of sintering conditions of zirconia-yttria-titania-based ceramics composite on the densification and microstructure

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Glass dissolution and bioactivity are two phenomena strictly related to each other in biocompatible glasses. By controlling the glass dissolution, the ions of the glass matrix can be released on controlled manner, and the glass can play a role as a resorbable or bioactive biomaterial, depending on the ratio of the oxides into glass composition. In this work, we studied the glass dissolution of three compositions of biocompatible glasses with potential applications in regenerative medicine. Glasses based on the system 47SiO2-(37- x)Na_2O-(10+x)CaO containing 6 wt% P_2O_5 (x = 0, 5 and 10) were obtained by melt-quenching at 1500°C/1h. The biocompatibility of these glasses was performed by immersion in a simulated body fluid solution up to 21 days, and then the glasses were characterized by XRD, FTIR, Raman spectroscopy and SEM. Glass dissolution kinetics essay was carried out in buffer solution at pH 7 and 37°C, and the ionic concentration of the leached ions was measured by ICP-OES. The results suggested that the speciation of silicate Q^n units plays an important role on dissolution kinetics at the very first time of dissolution, which, in turn, can increase bioactivity. On the other hand, once the hydroxyapatite layer is nucleated on the glass surface, it acts as a barrier between the glass and the aqueous medium, decreasing the dissolution rate. The overall results give new insights about the relationship between dissolution and bioactivity, and how to approach dissolution in bioactive glasses.