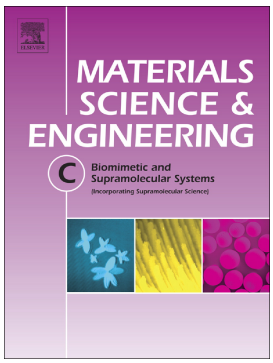

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Investigation on the properties of borate bonding agents: Ti6Al4V-porcelain bonding, chemical durability and preliminary cytotoxicity

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A B S T R A C T

The purpose of this study was to investigate the properties of the borate bonding agents (BBAS) including chemical durability, biocompatibility and bonding characteristics of porcelain to Ti6Al4V. The bond strength was performed by the three-point bending test. And the chemical durability and ion release of BBAS were tested by chemical soaking and inductively coupled plasma optical emission spectrometry (ICP-OES), respectively. Moreover, cytotoxicity was evaluated by cell viability assay and cell adhesion using human osteosarcoma cells (MG-63) and cell counter kit-8 (CCK-8) assay. To investigate the influences of composition and microstructure changes on all the properties mentioned above, the ^{11}B and ^{27}Al spectra and infrared spectra of BBAS were measured by solid-state nuclear magnetic resonance (SSNMR) and Fourier transform infrared spectroscopy (FTIR), respectively. Combined with all these properties of BBAS, the optimal addition proportion of Al_2O_3 into BBAS is 20 mol%. The relative contents of [BO3], [BO4], [AlO4], [AlO5] and [AlO6] have great influences on these properties of BBAS. BBAS, possessing excellent chemical durability, good biocompatibility and low ion release and being an effective way to improve the Ti6Al4V-porcelain bond strength, have significant clinical potentials in porcelain fused to metal restorations.

Keywords: Borate bonding agents, Metal-porcelain bond strength, Chemical durability, Biocompatibility, Titanium alloy.

1. Introduction

Possessing excellent biocompatibility, high corrosion resistance and outstanding mechanical properties, titanium and its alloys can be regarded as the optimal metal in metal-porcelain restorations [1,2]. However, the bond strength of titanium and porcelain is still unacceptable in a clinical application for a long period compared with conventional metals, such as Pd alloy, Au alloy, NiCr alloy and CoCr alloy [3-7]. The high affinity of titanium to oxygen results in the formation of nonadherent and excessive titanium oxide layer at a high temperature, especially at the titanium-porcelain fusing temperature above 800 °C, which will lead to a higher failure risk of titanium-porcelain restorations [8-10]. And in order to improve the bond strength of titanium and

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