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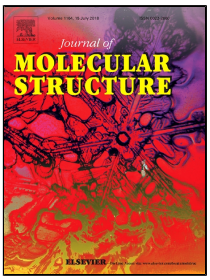

Effect of ZrO_2 sol-gel coating on the Ti 99.2 – porcelain bond strength investigated with mechanical testing and Raman spectroscopy

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Effect of ZrO_2 sol-gel coating on the Ti 99.2 – porcelain bond strength investigated with mechanical testing and Raman spectroscopy

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Abstract

Titanium in dental prosthetics is used for making prosthetic appliances permanently faced with low melting porcelain. This process is difficult due to the differences in chemical bonds characterizing both materials. The nature of the bonds varies sharply from metallic to ion-covalent metal on the metal-ceramic border. Improving the properties of the titanium-ceramic combination is a widely explored topic in the field of material engineering. The article presents the results of titanium 99.2 – bioceramics system interface bond strength investigated with mechanical tests and Raman spectroscopy. Titanium substrate was prepared with sandblasting (Al_2O_3) combined with ZrO_2 sol-gel layer and finally covered with low fusing porcelain (Duceratin, GC Initial). In order to investigate the effects of metal-ceramics interface bond strength, mechanical testing (three point bending) microscopic (SEM/EDX), spectroscopic (RS) were performed. Applied technique of substrate preparation made it possible to improve the effects of porcelain adhesion to Ti 99.2 which was confirmed by bond strength improvement in the area of titanium/bioceramic interface. Furthermore, the Raman spectroscopy showed results of phase distribution change along the interface which proved the different character of metallic and ceramic chemical bonding, which has changed slightly from metallic to ionic and covalent nature. Adequate interface bond strength and phase composition of titanium/sol-gel – bioceramics system is essential to the durability improvement of the dental implants and also influences in substrate functional properties enhancement.

Keywords: titanium 99.2, porcelain, bond strength, ZrO_2 interlayer, sol-gel coating