Advanced Materials Research, vol.980, 2014, pages 13-17

Bioactivity behavior of YSZ-Al2O3/10HAP bioceramics composites in simulated body fluid

Abstract

Yttria-stabilized zirconia and alumina made significant contributions to the development of health care industry, specifically as orthopedic and dental materials. Both bioceramics are nearly inert ceramics, as they do not allow the interfacial bonding with tissue. Thus, it is necessary to provide bioactive surrounding as to elicit a specific biological response at the interface of material. This research reported the microstructure and bioactivity behavior of YSZ-Al2O3/10HAP with 30 wt. % and 60 wt. % of YSZ content. Powders were mixed before being compacted at 225MPa using uni-axial press machine. The composites were sintered at 1200°C with heating rate of 10°C/min. Invitro bioactivity behavior of the composites were evaluated by immersing the composites into simulated body fluid. Results from x-ray diffraction pattern, confirmed the phase formation of apatite by the presence of Ca2P2O7, and CaO that might be useful on implant cell interaction in a body environment. The apatite formation was observed on the surfaces of the composites by SEM only after 9 days of immersion and subsequently apatite nucleation increased with prolonging immersion time. The dynamic changes in pH, between ion concentration in SBF and bioceramics surfaces correspondedwith an immersion time. Up to 30 days of immersion, the pH value of SBF stabilized approximately around pH 7.4 - 7.6, similar to the human blood plasma. Formation of apatite on composites surface of prepared YSZ-Al2O3/10HAP bioceramics may contribute to the improved biocompatibility and osteoconductivity.

Keywords; Apatite; Bioactivity; Bioceramics; Simulated body fluid