
CANCELED - Past, present, and future of bioactive glass-ceramics

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Abstract

In 1969, Prof. Larry Hench discovered the first man-made material which forms a chemical bond with bone and initiated a whole new field of bioactive glasses and glass-ceramics. Later on, other bioactive glass-ceramics, such as Cerabone®[®], Bioverit®[®], and Biosilicate®[®] were developed and commercialized. Currently, there is an intense search for novel compositions and microstructural design of these materials. Additionally, the fracture toughness of these glass-ceramics (1-2 MPa.m^{1/2}) is still in the lower range compared to cortical bone (2-12 MPa.m^{1/2}). Bioactive glass-ceramics have been considered for low and medium load-bearing conditions, but their toughness (to K_{IC} > 3 MPa.m^{1/2}) and bioactivity should be promoted. 3D porous and mesoporous glass-ceramics for incorporation of biofactors, drugs, and cells are also promising for biomimetic regeneration of the complex structures of bone and teeth. Another potential application is hyperthermia treatment of cancer using magnetic bioactive glass-ceramics, and several other relevant examples could be given. Due to their inherent bioactivity and improved mechanical properties, bioactive glass-ceramics continue to be key candidates in the quest for adequate bone substitutes and scaffolds. There are clear signs that alone or in combination with other materials, such as polymers, these materials will find a wealth of applications for bone therapy in our aging population.

Keywords: Glass, ceramic, Bioactivity, Mechanical Properties, Biomedical

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