Chapter 3

Synthesis and Characterization of Doped Bioactive Glasses

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3.1 BIOACTIVE GLASSES OBTAINED BY MELTING AT HIGH TEMPERATURE—THE BEGINNING

3.1.1 Overview

At the end of the sixties, Hench (1990) managed to obtain an intimate bond between the first bioactive material and bone. This material is a bioactive glass based on SiO_2, CaO, Na_2O, and P_2O_5 and is named Bioglass 45S5 (Ogino et al., 1980). When it is soaked in a body fluid, it has the property of developing a hydroxyapatite carbonate (HAC) layer, forming part of the family of crystallized apatites on its surface. This HCA layer allows the implant to chemically anchor to the host environment in a stable manner.

At present, Hench's Bioglass 45S5 (Ogino et al., 1980) is the best known and most widely used bioactive glass. Composed of 46.1% of SiO_2, 26.9% of CaO, 24.4% of Na_2O, and 2.6% of P_2O_5 in molar percentages, this glass is based on a silicate network containing other components, similar to window glass, except that it contains more calcium and less silica. Window glasses also do not contain phosphorus.

These bioactive implants are currently used in many parts of the human body including the middle ear bones, teeth, knees, hips, etc.

In order to improve the bioactivity performance, many additions were made to the initial composition of Hench (Ogino et al., 1980). However, the glasses or glass-ceramics listed up to now in the literature generally contain five, six, or even more components (the most often cited being, in addition to the four Bioglass 45S5 compounds: CaF_2, B_2O_5, Al_2O_3, MgO, K_2O, etc.) (Andersson et al., 1990; Brink et al., 1997). Under these conditions, it is difficult to understand the influence of each of these compounds on the properties of the glasses

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