TABLE 9.4 Properties of Bioglass (Jones, 2013)

Property	Value
Density	$2.7\,g\,cm^{-3}$
Network connectivity	2.12
Glass transition temperature	538°C
Onset of crystallization	677°C
Coefficient of thermal expansion	$15.1\times10^{-8}°C^{-1}$
Young's modulus	35 MPa

Bioglass not only bonds rapidly to bone, it also stimulates bone growth in the region adjacent to the bone-glass interface (Jones, 2013; Jones et al., 2016). The mechanism for this has been elucidated and the process appears to occur by initial dissolution of the upper layers of the glass followed by the formation of a layer of carbonated hydroxyapatite (hydroxycarbonate apatite, HCA) on the surface of the glass. This latter step is attributed to the presence of elevated levels of calcium ions and soluble silica species in the region around the implant caused by the initial dissolution. These soluble species stimulate osteogenic cells to produce bone matrix, the inorganic component of which is HCA (Hench and Polak, 2002). The bioactivity of this glass arises from the rapid rate of dissolution and consequent speed of deposition of the HCA layer. These steps then stimulate regeneration of the adjacent bone.

Although there has been a huge amount of research since the original bioactive glass formulation was reported, including further work on conventional silicate glasses of varying composition, and also on phosphate and borate glasses, the biological properties of 45S5 (Bioglass) have not been improved upon (Jones, 2013).

The first commercial product that employed particulate Bioglass was a granular substance for use in periodontology, known as PerioGlas. This product, which is now sold by NovaBone Products LLC of Alachua, Florida, came onto the market in 1993 (see Fig. 9.1). It received FDA approval in this year and the CE mark in 1997, and was designed for the clinician to press it into place within periodontal defects during surgery. The particles in this product have sizes in the range 90–710 μm and when used in this way the material has had considerable clinical success. It has been found to stimulate regrowth of bone to such an extent that an affected tooth can be readily saved. PeroGlas particles can also be used to prepare compromised alveolar bone to receive titanium implants, where the resulting