orthopedic application. It is important to select a bioactive glass with elements that are mainly present within human body in order to minimize the risk of rejection by the tissue. Bioactive glasses also show weak chemical durability in neutral to slightly alkaline solutions (pH: 7.35–7.45). Once bioactive glass is implanted within human body the biological reaction between cell-surface will begin and once bioactive glass is immersed in blood plasma at body temperature, the glass initially releases the loosely bonded glass network through the fast ion exchange with the exiting hydrogen ion. Finally, the number of ion exchange make environment more acidic (higher pH), which lead to an attack to the silica network and result in formation of Si–OH (silanols) at cell-surface interface. Two other elements including phosphate and calcium from the glass and also within the solution generate amorphous HA. At this stage the HA layer provides great cell-surface bonding within tissue surface and biomaterial (Hench and Polak, 2002). It was also demonstrated in a study in which human osteoblasts were cultured on porous 58S bioglass surface, the fine cellular projections played a role of a bridge and connected small pores of bioglass, as shown in Fig. 17.3 (Gough et al., 2004).

Basically, biomaterials are capable of producing HA layer at their interface, which is usually known as bioactive biomaterials. HA and Silica gel layer will form at the surface and are known as essential characteristics of bioactive glasses. HA is a nondegradable biomaterial and is known to form in vitro on a composite of bioactive glass fibers (Marcolongo et al., 1997). Currently, it has been shown that osteogenesis and angiogenesis can be stimulated by inorganic ions, which dissolve from bioactive glasses and therefore, bone tissue regeneration was observed as shown in Fig. 17.4 (Hench, 2009; Hoppe et al., 2011; Ducheyne and Qiu, 1999).

On the one hand, the bioactive glasses with ion dissolution alter the pH, which become more alkaline at the cell-surface interface and eventually result in the viability of various bacteria (Hoppe et al., 2011; Stoor et al., 1998, 2001; Munukka et al., 2008; Zhang et al., 2010). Boccaccini and his group developed various composites where bioactive glass particles or fibers were utilized to reinforce organic polymers. They found out that composite will have osteoconductive and osteoinductive properties once bioactive glass is exposed to extracellular fluids (Boccaccini et al., 2012). Recently, fabrication of 3D porous scaffolds has become more popular. This type of 3D substrate allows 3D growth of bone, and therefore, bioactive glass and polymer will dissolve and be substituted by new tissue.

In recent years, many implants were used in clinic for various applications including oral, orthopedic, and cranial, which consist of organic polymers as well as glass fibers and in this case osteoinduction and osteoconduction initially provided by bioactive glass (Nganga et al., 2012). Antimicrobial behavior is another cutting-edge research in the field of implants and relatively tissue engineering, which result from the ions released from the glass. The bioactive glasses such as S53P4 and 45S5 have been investigated commonly