(Carta et al., 2009; Hidi et al., 2013; Sharmin et al., 2013). The incorporation of $B_2O_3$ leads to a cross-linking between the phosphate chains through the formation of P–O–B bonds.

### 8.2.1 In Vitro Bioactivity and Biocompatibility

The bioactivity of a glass in vitro is usually evaluated by its ability to form an HAP layer on its surface upon immersion in SBF. In vitro bioactivity of a glass depends on the chemical composition, network structure, size, and surface properties (surface area, pore size, pore volume, pore structure) of the particles or scaffolds and various organic compounds present in their composites. The process transformation of the bioactive glass to bone tissue can be classified into chemical (1–5) and cellular stages (6–12), although some stages occur almost simultaneously, such as 6 and 7 with stages 3–5 (Fig. 8.2) (Hench et al., 1971, 2014; Filho et al., 1996; Hench and Clark, 1978).

The chemical process of HAP layer formation on the surface of silicate bioactive glasses has been widely studied in vitro. When a bioactive glass is immersed in SBF, $Na^+$ and $Ca^{2+}$ ions are exchanged for hydrogen ions on the glass surface. The pH of the solution increases and leads to degradation of a network

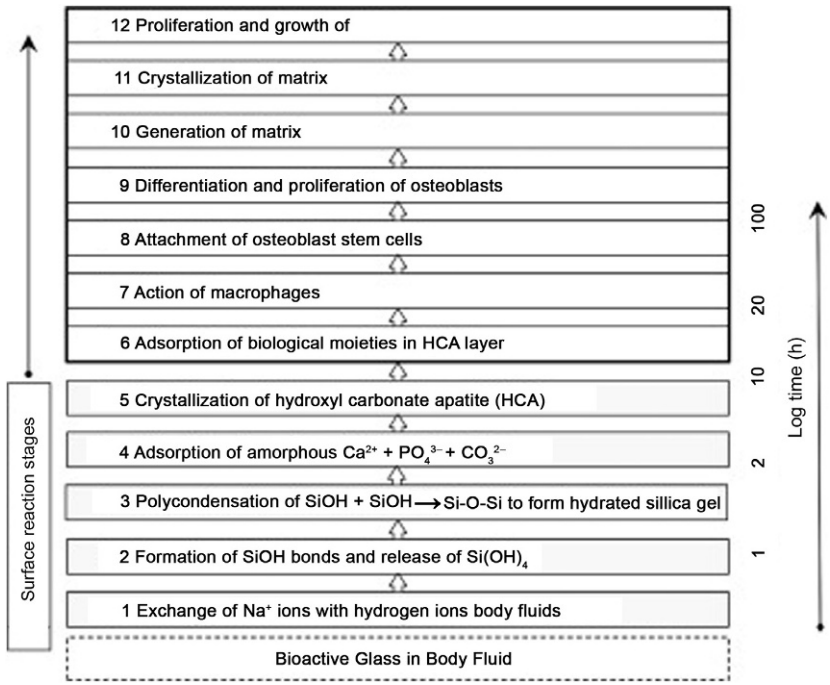


**FIG. 8.2** Stages of interfacial reactions between bioactive glass and surrounding bone tissue. *(Hench, L.L., Roki, N., Fenn, M.B., 2014. Bioactive glasses: importance of structure and properties in bone regeneration. J. Mol. Struct. 1073, 24–30.)*