modifying matrix of composites for tissue engineering applications. These materials have the ability to modify and control a wide range of biological and chemical properties. Bioglass 45S5, also known as Bioglass, is a glass composed of 45 mol% SiO_2, 24.5 mol% CaO, 24.5 mol% Na_2O, and 6.0 mol% P_2O_5.

Silica has been used as the major component of glass composition and is also most widely researched with respect to changing its amount to alter the properties of bioactive glasses. Silica-based glasses comprise of amorphous network structure of silicate tetrahedron linked together at the oxygen centers (Fig. 5.3). Nonbridging oxygen atoms attached to silicon result in the opening of silica network structures. In ion doped bioactive glass used in bone regeneration, the bridging oxygens of the network are replaced with nonbridging oxygens, causing the glass structure to open up. Several properties of bioactive glass are dependent on the number of modifier ion-oxygen bonds and nonbridging oxygen bonds (Strnad, 1992). Effects of detailed structural features of silicate glasses on different physical and chemical properties have been reported (Shelby, 2005; Cormack and Tilocca, 2012).

The composition of bioactive glass is different from that of the regular soda lime silica glasses in which silica is 65% of the weight. The basic components of bioactive glass are SiO_2, Na_2O, CaO, and P_2O_5 (Mahyudin and Hermawan, 2016). According to Hench and Anderson, glass can be characterized according to its three main features; the amount of SiO_2 in the glass (45–60 wt%), the Na_2O and CaO content must be high, and a high CaO/P_2O_5 ratio. A higher content of SiO_2 is known to slow down the surface resorption of the glass ions, resulting in the reduction of bioactivity, whereas an excessively low content of SiO_2 results in the formation of completely soluble monomeric silicate units. The amount of silica in bioactive glass strongly influences the precipitation of carbonated

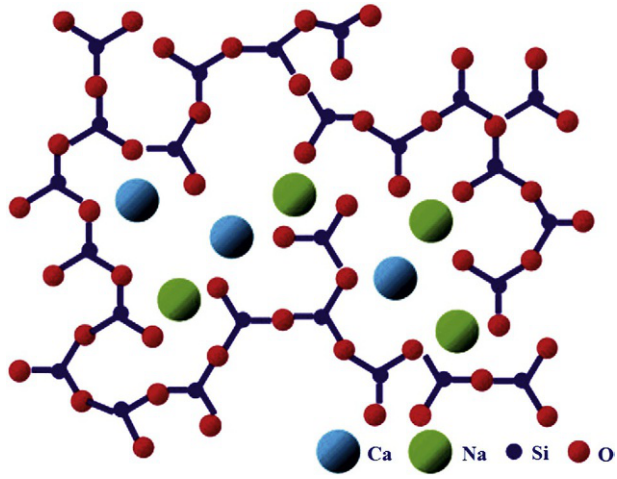

FIG. 5.3 Disordered structure of a glass in the SiO_2-CaO-Na_2O system (Vallet-Regí, 2001).