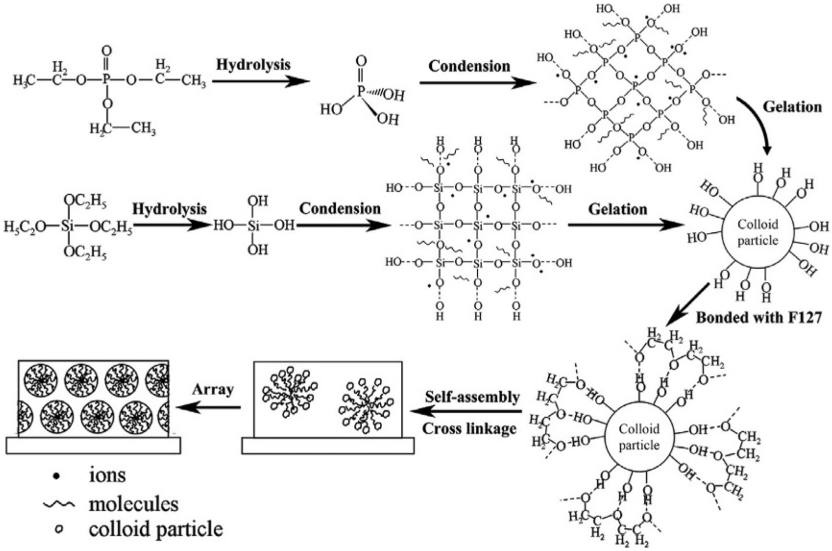

**FIG. 4.3** Schematic illustration of the sol-gel process with the addition of F127 for the preparation of 45S5 MBGC coatings (Huang et al., 2013).

MBG coatings on metal alloys are generally prepared by a sol-gel dip-coating method using structure-directing agents as templates (Huang et al., 2014, 2013; Wang et al., 2010; Gomez-Vega et al., 2001). Huang et al. (2013) illustrated the formation mechanism of 45S5 MBGC coatings using F127 as organic templates, as shown in Fig. 4.3. TEOS and triethyl phosphate (TEP) are hydrolyzed and subsequently condensed to form a colloid network under the catalysis of dilute nitric acid. The phosphorous and silicon ions are jointed, forming the network structure. During the gelation process, free hydroxyls derived from the hydrolysis of TEOS and TEP are exposed on the colloid surfaces. The triblock copolymer F127 includes the hydrophilic segment of PEO and the hydrophobic segment of poly(propylene oxide) (PPO). In aqueous conditions, PPO forms the core of aggregates and PEO exists as shells around the core (Fig. 4.3). The hydrophilic oxygen atoms in F127 are linked with the free hydroxyls on the colloid surfaces by hydrogen bonds. With the evaporation of solvents in the sol-gel coating, spherical F127 micelles were gradually formed via the self-assembly process. The inorganic species arrange regularly around the micelle surfaces. After the heat-treatment process, a mesoporous structure was formed in the final coatings due to the removal of F127 (Fig. 4.3) (Huang et al., 2013). With the increase in calcium percentages, the crystallinity of the MBG coatings increases, and thus the surface area and pore volume decrease (Wang et al., 2010).