

(Kresge et al., 1992; Beck et al., 2016). Surfactant liquid crystal structures as organic templates are used to fabricate mesoporous MCM-41 with a hexagonal structure and a very narrow pore-size distribution. The pore dimensions and structures of mesoporous materials mainly depend on the chain length of surfactant and on solution chemistry (Kresge et al., 1992; Beck et al., 2016). The formation mechanism of MBGs is similar to that of MCM-41, in which structure-directing agents are incorporated into the sol-gel process. The frequently used organic templates include cetyltrimethyl ammonium bromide (CTAB), EO₂₀PO₇₀EO₂₀ (P123), EO₁₀₀PO₆₅EO₁₀₀ (F127), dodecylamine (DDA), hexadecylamine, and span 80 (Wang and Li, 2016; Yun et al., 2007; Li et al., 2015a, 2008a; Huang et al., 2012; Zhu et al., 2014; Wang et al., 2012; Liang et al., 2015; Hu et al., 2014; Miao et al., 2013). These organic templates as structure-directing agents may self-assemble into micelles under appropriate conditions, and attach to inorganic precursors via noncovalent interactions including van der Waals forces, hydrogen bonding, and electrostatic forces (Wu and Chang, 2012; Wan et al., 2006). The ordered mesophases of organic-inorganic composites are formed through an EISA process (Wu and Chang, 2012; Wan et al., 2006). After the surfactants are removed by calcination or solvent cleaning, the MBGs with well-ordered mesopores are obtained (Wu and Chang, 2012; Wan et al., 2006). Notably, the organic templates play great roles in the mesoporous structure, surface area, pore volume, and pore size of MBGs, as shown in Table 4.1. Under the structure-induction of F127, the as-formed MBGs have better and longer range mesopores with a three-dimensional (3D) *Im3m* structure and the characteristic XRD peaks due to (1 1 0), (2 0 0), and (2 1 1) diffractions located at $2\theta = 0.95^\circ$, 1.30° , and 1.61° , respectively (Yun et al., 2007). MBGs induced by CTAB and P123 exhibit a hexagonal (p6mm) mesoporous structure (Yan et al., 2004; Li et al., 2015a). Li et al. (2015a) have reported that the well-ordered mesopores of MBGs are turned into poorly ordered wormlike mesostructures with the decrease of CTAB concentrations. Generally, CTAB is more difficult to induce the formation of ordered mesopores for MBGs than P123 and F127. For CTAB, the appropriate reaction temperatures and concentrations are prerequisites to control the mesoporous structure and order degree of MBGs.

4.2.2 MBG Particles

To date, different MBG forms including particle, fiber, coating, and scaffold have been fabricated to treat specific bone defects suffering from osteonecrosis, arthritis, osteoporosis, bone fracture, trauma, and bone tumor (Huang et al., 2012; Hua et al., 2014; Shruti et al., 2016; Qi et al., 2017). Among them, the MBG particles are especially fit for bone filling materials. In 2004, highly ordered MBGs were synthesized by an EISA method using nonionic block copolymers as templates, but they exhibited irregular shape and large size with approximately several tens of micrometers (Yan et al., 2004). As compared with the irregular particles, the spherical particles have better physicochemical and biological properties