and metabolite adsorption (Owens et al., 2016b). The following are some of the important and popular techniques by which 3D mesoporous glass scaffolds are fabricated.

### *18.5.3.1 Polyurethane Sponge Template (PUST) Method*

The development of a 3D mesoporous bioactive glass scaffold (MBAGS) using a polyurethane (PU) sponge has been reported (Zhu et al., 2008). Combined with a P-123 surfactant (the structure direction determinant), PU sponges are used as co-templates prior to an evaporation induced self-assembly (EISA) process. The average pore diameter of this macroporous structure spans across 200–400 µm, with a mesopore wall size of around 5 nm. In vitro analysis of these MBAGS involved assessments with varying chemical compositions in SBF. Cell culture studies using human bone cells revealed better cell attachment levels that were observed with the 80S15C along with formation of a thick layer of HCA post immersion in SBF. PUST method can be very effective for fabricating hierarchical macro and mesoporous bioactive glass scaffolds (MMBAGSs) of the CaO-$SiO_2$-$P_2O_5$ and CaO-MO-$SiO_2$-$P_2O_5$ systems.

A modification of this approach infuses the scaffolds with essential trace elements like Mg, Zn, or Sr. After which they are fabricated using combinations of block copolymer and PU sponges as cotemplates. The technique entails immersing the PU sponges in the CaO-MO-$SiO_2$-$P_2O_5$ sol. Following uniform coating of the sponges with the sol, drying at room temperature and squeezing out the excess sol, the PU sponge support is decomposed by raising the temperature to around 700°C at a rate of 1°C $min^{-1}$ leaving behind an intact mesoporous MBAG template. Another variant of this technique involves the use of silk as an additive to the mesoporous bioglass scaffolds (MBGs) by the preparation and addition of silk protein-based solutions (using water as the solvent) of the order 2.5 and 5.0% (*w*/*v*) and subsequent immersion of the previously calcined MBGs (Wu et al., 2010; Jiang et al., 2009; Zhao et al., 2009). Silk had a significantly positive effect in terms of defining the pore morphology and imparting greater mechanical strength to the scaffolds. The treatment of MBG scaffolds with silk solution is a logical approach as it offers favorable biocompatibility, a slow rate of degradation, a uniform pore network (without affecting porosity) and imparts mechanical properties conducive for bone tissue engineering.

Enhanced cellular activity of the seeded cells was observed on PUST-derived scaffolds in terms of attachment, proliferation, and differentiation for all MBAG templates synthesized using the PUST method. This was expressed in terms of elevated alkaline phosphatase (ALP) levels. In the case of trace element infused scaffolds, increased cellular proliferative activity was also attributed in part to the release of Ca, P, Si, Mg, Zn, and Sr into the cell culture medium (Wang et al., 2011). Moreover, no aberrations were detected with respect to changes in phase composition from the MMBAGS without the trace elements (Wang et al., 2011). Hence, this could prove to be a reliable technique by which nontoxic MMBAGS can be predictably synthesized, provided their trace element