Therefore, this is a very attractive approach for designing MBAGSs boasting high specific surface area and pore volume with elevated levels of HA formation tendencies and simultaneous drug loading. The implications are substantial for developing novel bioactive materials as amenable drug delivery systems in the guise of a synergistic targeted tissue/organ therapy modality such as for cancer treatment of bone marrow cells (Knežević et al., 2013).

18.5.3.3 3D Printing and Synergy With the Spin Coating Technique

3D printing, also referred to as additive manufacturing, solid free—form fabrication and prototyping, is yet another useful and convenient approach for the manufacture of hierarchal scaffolds for the purpose of tissue engineering (An et al., 2015). The parameters that define an ideal 3D scaffold include a greatly enhanced porosity index with intricate pore networks that play host to a variety of cellular functions and activities such as proliferation, migration, differentiation, and infiltration (Loh and Choong, 2013). Conventional manufacturing techniques such as solvent casting, particulate leaching, and foaming allow for restricted levels of tinkering and tweaking of pore size and network. One of the most sought after characteristics in scaffold design are consistency and reproducibility—elusive traits that prove to be a precarious undertaking if one resorts to conventional techniques alone. In order to surpass these glaring roadblocks in the face of inevitable progress in scaffold science, 3D printing has emerged in recent years as a viable and formidable tool for fabricating bespoke scaffolds with controlled pore morphology (Leong et al., 2003). Currently there are >30 different kinds of documented protocols addressing techniques for 3D printing. Out of all these stereolithography, selective laser sintering (SLS), color jet printing, and fused deposition modeling (FDM) techniques are the most frequently utilized, and therefore the principal fabrication method in many scaffold design investigations. This is also in large part due to the ability of these techniques to successfully utilize plastic material. Design of scaffold architecture has a strong bearing on both the final mechanical property and cell behavior near the construct. The addition of a nano-structured mesoporous bioactive glass (MBG) coating on the surface of β-TCP scaffolds for improving upon the surface chemistry and topography of the templates have been investigated (Zhang et al., 2015). A synergistic effect in terms of enhanced mechanical and physicochemical properties comparable to the top range of cancellous bone, having a compressive strength index of up to 12 MPa, was observed. This was coupled with promising levels of angiogenesis, osteogenesis, and protein expression, desirous for upregulating bone formation levels significantly.

The 3D printing and spin coating technique synergy system makes use of the 3D plotting principle using β-TCP pastes for designing nanolayer functionalized scaffolds for bone regeneration (Zhang et al., 2015). Pastes are initially prepared by mixing β-TCP powders with 6 wt.% polyvinyl alcohol (PVA) solution in fixed mass ratios. Following loading of the homogenous pastes in the