



**FIG. 8.3** SEM images of the fractured sections of hollow HAP microspheres resulting from the reactions between borate glass (10 Li<sub>2</sub>O, 10 CaO, and 80 B<sub>2</sub>O<sub>3</sub>) microspheres and (A) 0.02 M K<sub>2</sub>HPO<sub>4</sub> solution, (B) 0.1 M K<sub>2</sub>HPO<sub>4</sub> solution, and (C) 0.25 M K<sub>2</sub>HPO<sub>4</sub> solution, followed by sintering for 2 h at 600°C. (Yao, A., Ai, F., Liu, X., Wang, D., Huang, W., Xu, W., 2010. Preparation of hollow hydroxyapatite microspheres by the conversion of borate glass at near room temperature. *Mater. Res. Bull.* 45, 25–28).

directly and indirectly through the eluate. Direct contact allows immediate action of a glass in cell culture and depends on the adherence of cells as well as the glass properties (chemical composition and surface characteristics). The eluate was created when converting a glass in HAP that can affect the biological ability of cells. Borate ions realized from a bioactive glass play an important role in osteogenesis and angiogenesis (Hakki et al., 2010; Durand et al., 2014). The attachment, proliferation, differentiation, and biosynthetic reactions of cells on the glass surface are an important indicator of the osteogenic potential of the test biomaterial. The presence of a calcium phosphate or HAP layer on the surfaces of the glass is crucial for attachment of biomolecules, cells, and interaction with the surrounding tissue (Barrère et al., 2006). Wiederhorn et al. (Wiederhorn et al., 2011) showed that adhesion of osteoblast cells depends on the formation of a calcium phosphate reaction layer on the surface of the glass. Calcium borate glasses showed a more rapid formation of a calcium phosphate layer and stronger adhesion of cells than silicate and calcium-free borate glasses. Scaffolds of a borate glass (Na<sub>2</sub>O, K<sub>2</sub>O, MgO, CaO, P<sub>2</sub>O<sub>5</sub>, B<sub>2</sub>O<sub>3</sub>) were found to enhance osteoblasts (MC3T3-E1) proliferation, protein secretion, ALP activity, and cell migration, with minor cell apoptosis at a high dose of boron (Wei et al., 2014). Compared to a CaSiO<sub>3</sub> coating on Ti substrates, boron-modified