There are two weak bonds caused by the presence of two types of oxygen (bridging and nonbridging) in the structural network of borate glasses. The bridging oxygen is shared between two boron (B^{3+}) ions. The nonbridging oxygen creates bonds not only with a boron ion but also with a modifier ion. In the bridging oxygen, two electrons are bonded with two different boron ions (Kindrat et al., 2017).

A faster dissolution rate of borate-based glasses makes them the material of choice for tissue regeneration (Brink et al., 1997). Moreover, the physical and chemical properties of glass can be optimized to fulfill the desired tissue regenerative needs by changing the composition of the glass fillers, (SiO_2 and B_2O_3). A study has shown that the composites containing 50 wt% PCL and (1) 50 wt% borate bioactive glass or (2) 50 wt% Bioglass or (3) a mix of 25 wt% borate bioactive glass and 25 wt% Bioglass particles possess an altered degradation rate. The results demonstrated that the quicker conversion of borate bioactive glass fillers to HAp could improve the effectiveness of the PCL-borate bioactive glass system compared to the Bioglass containing system (Yao et al., 2007).

Borate bioactive glasses are known for their faster and complete conversion to HA, which can lead to faster in vivo new bone formation than for the silica based bioactive glass. The in vitro degradation and HA formation on the grid-like microstructure of borate glass scaffolds with varying filament diameters (130 ± 10 to 300 ± 20 μm) was carried out in SBF. The resorption rate was reported to be dependent on the diameter of the filament, whereas the apatite formation was influenced by the particle size and the sample/SBF ratio. Scaffolds with a diameter of 130 ± 10 μm were reported to resorb at a faster rate than the scaffolds with larger sized filaments (Deliormanlı, 2013).

An injectable composite cement of borate bioactive glass and chitosan was formulated to repair bone defects in a rabbit femoral condyle model. The ability to inject and setting time of the cement were reduced, whereas the compressive strength of the cement was increased from 8 ± 2 to 31 ± 2 MPa. Immersion of the cement samples in PBS resulted in the formation of the HA, confirming the bioactivity of the cement. Osteoblastic MC3T3-E1 cells showed good proliferation and ALP activity upon incubation in media containing ionic products of cement (Cui et al., 2017). Images of different sections of each femur used to analyze the bone healing process are shown in Fig. 5.5.

After 12 weeks of implantation, new bone formation within the defects was observed and greater bone formation was observed for the borate bioactive glass than the defects implanted with the commercially available $CaSO_4$. Results have shown that the developed injectable borate cement is a promising candidate to repair bone defects through minimally invasive surgery.

A study has shown the ability of Cu-doped borate bioactive glass microfibers to heal skin wounds in rodents. Soaking of the microfibers in simulated body fluid resulted in a rapid release of Ca, B, and Cu ions into the solution, causing the precipitation of HA on the surface. The release of ions from the fibers did not cause any in vitro toxicity to the human umbilical vein endothelial