

Summary

This thesis deals with five types of biocomposites. The first one is bioglass 45S5 reinforced with hydroxyapatite (HA) based biocomposites. Second is bioglass 45S5 reinforced with HA and TiO₂ based biocomposites. Third is bioglass 45S5 reinforced with HA and ZrO₂ based biocomposites. Fourth is bioglass 45S5 reinforced with HA, Fe₂O₃ and CoO based biocomposites. Fifth is bioglass 45S5 reinforced with HA, TiO₂ and Nb₂O₅. During an investigation, a comparative study was made on physical, mechanical and bioactive properties of HA, TiO₂, ZrO₂, Fe₂O₃, CoO, Nb₂O₅ reinforced 45S5 bioactive glass based biocomposites. The following conclusions were obtained from this investigation.

- ❖ Crystallization of bioactive glasses produces crystalline phases of sodium calcium silicate [Na₂Ca₂Si₃O₉ & Na₂CaSi₃O₈]. Crystallization of bioactive glasses decreases in vitro bioactivity. Crystallization of bioactive glasses increases their chemical stability, density, young's, shear and bulk modulus, compressive strength, microhardness and flexural strength while decreases their Poisson's ratio.
- ❖ Reinforcement of HA, TiO₂, ZrO₂, Fe₂O₃, CoO, Nb₂O₅ in 45S5 bioglass decreases its glass nucleation and crystallization temperature.
- ❖ There is no effect on in vitro bioactivity due to the reinforcement of 2% CoO in 45S5 bioactive glass but reinforcement of more than 4% of CoO in it, increases toxicity nature of biocomposites.

- ❖ pH values of reinforced HA, TiO₂, ZrO₂, Fe₂O₃, CoO, Nb₂O₅ in 45S5 bioglass increased up to 14 days after that decreased.
- ❖ Reinforcement of HA, TiO₂, ZrO₂, Fe₂O₃, CoO, Nb₂O₅ in 45S5 bioglass, enhances its density in the order of CoO > ZrO₂ > Fe₂O₃ > Nb₂O₅ > TiO₂ > HA.
- ❖ Reinforcement of HA, TiO₂, ZrO₂, Fe₂O₃, CoO, Nb₂O₅ in 45S5 bioglass enhances its compressive strength in the order of BGHATiNb > BGHAFeCo > BHZ > BGHATi > BC.
- ❖ Reinforcement of HA, TiO₂, ZrO₂, Fe₂O₃, CoO, Nb₂O₅ in 45S5 bioglass enhances its flexural strength.
- ❖ Reinforcement of HA, TiO₂, ZrO₂, Fe₂O₃, CoO, Nb₂O₅ in 45S5 bioglass enhances its young's modulus .
- ❖ Reinforcement of HA, TiO₂, ZrO₂, Fe₂O₃, CoO, Nb₂O₅ in 45S5 bioglass enhances its hardness value in the order of BGHATiNb > BHZ > BGHAFeCo > BGHATi > BC.

Hence, the present research work concluded that HA, TiO₂, ZrO₂, Fe₂O₃, CoO, Nb₂O₅ reinforced in 45S5 bioglass based biocomposites would be potential biomaterials for biomedical application.

Future Work

1. Using sol-gel process to make bioactive glass.
2. In Vivo studies of HA, TiO₂, ZrO₂, Fe₂O₃, CoO, Nb₂O₅ reinforced 45S5 bioglass based biocomposites.
3. Measurement of cell toxicity, cell viability, cell attachment, proliferation, angiogenic and osteogenic properties for HA, TiO₂, ZrO₂, Fe₂O₃, CoO, Nb₂O₅ reinforced 45S5 bioglass based biocomposites.