Preface

The 1393 bioactive glass has been used widely because of bonding capability with hard & soft tissues. One of the significant application of bioactive glass is as an artificial bone graft. Therefore, it is a promising material in the field of biomedical application. It has inferior mechanical properties in comparison to cortical bone. This property enables the use of 1393 bioactive glass in various forms in tissue engineering, although it has several limitations.

Chapter 1 consists of literature survey regarding the studies on in vitro bioactivity and physical-mechanical properties of substituted 1393 bioactive glasses. It also gives details; description of literature survey about the CoO, TiO_2 and ZrO_2 doped 1393 bioactive glasses. The motivation for the selection of Co, Ti and Zr are due to their excellent biological properties. These are the major components of the oxygen-carrying part of blood cells and significantly improve the blood vessel formation.

Chapter 2 presents a brief description of the material synthesis, sample preparation and characterization techniques viz. preparation of bioactive glasses by melting route, characterization of bioactive glasses by FTIR and XRD, measurement of physical properties of bioactive glasses and assessment of in-vitro bioactivity in SBF, identification of HCA formation by pH, FTIR and SEM, mechanical properties of bioactive glasses (destructive test) and elastic moduli of bioactive glass (non-destructive test).

Chapter 3 reports the effect of doping TiO_2 in 1393 bioactive glass, and the comparative investigation was made on physico-mechanical and bioactive properties of titanium oxide doped 1393 bioactive glasses. The following conclusions were drawn from this investigation. An increase in titanium oxide content in this series of glasses

increased bioactivity. This is also supported by pH and SEM analysis. FTIR results showed the silicate network structure in prepared bioactive glasses and increasing the titanium oxide content in 1393 bioactive glass increase the density, flexural strength, compressive strength and micro hardness.

Chapter 4 reports preparation of zirconium dioxide doped 1393 bioactive glasses. The following conclusions were drawn from this investigation. The XRD analysis of the bioactive glasses before immersing into SBF showed the amorphous nature of the glasses. FTIR reflectance spectra, pH behavior, XRD and SEM images indicated the formation of hydroxyl apatite (HA) layer on the surface of the zirconium dioxide containing bioactive glasses after immersing in simulated body fluid (SBF). FTIR results showed the silicate network structure in prepared bioactive glasses and increasing the zirconium dioxide content in 1393 bioactive glass increase the density, flexural strength, compressive strength and micro hardness. Hence, the present investigation clearly indicates that ZrO_2 substituted bioactive glasses would be potential biomaterials for biomedical applications.

Chapter 5 reports the destructive & non-destructive properties of cobalt oxide substituted 1393 bioactive glasses. This is also supported by pH and SEM. FTIR results showed the silicate network structure in prepared bioactive glass and increasing the cobalt oxide content in 1393 bioactive glass increased the density, flexural strength, compressive strength and micro hardness. An increase in the elastic modulus of the cobalt contained 1393 bioactive glasses; Poisson's ratio slightly decreases with increasing in cobalt oxide.

Chapter 6 discusses the development of zirconia substituted 1393 bioactive glasses for orthopaedic application. A comparative investigation was made on physico-mechanical

and bioactive properties of zirconia oxide substitute 1393 bioactive glass. The following conclusions were drawn from this study. The XRD analysis showed the amorphous nature of the glass and FTIR absorbance spectra, pH behavior; XRD and SEM images showed the formation of HCA layer on the surface of bioactive glasses after putting in SBF. Densities of substituted bioactive glasses are increased with increasing concentration of ZrO_2 while their chemical durability decreased. So it can be concluded from the experimental work that all the ZrO_2 substituted bioactive glass have shown improved properties. Among all the samples the G-3 glass is the best one as it has shown high pH value which suggests the formation of HCA layer. It can be observed from the FTIR diagram of G-3 that all the bonds are showing prominent peaks and SEM images are also showing impressive results of HA layer formation. The prepared bioactive glasses can be used for bone tissue engineering applications.

Chapter 7 gives the summary of the whole thesis in a nutshell and presents the future work and application of this work in research and development area.