

*Dedicated to the almighty above, to my father,  
Late Shri Akhilesh Chandra Bharti, who  
unfortunately didn't stay in this world long enough  
to see his son become a doctor, to my mother  
Usha Rani and my wife, Priyanka, who didn't let  
me lose my calm and composure.*

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This is to certify that the work contained in the thesis entitled: “**SYNTHESIS AND CHARACTERIZATION OF Ti BASED METAL CERAMIC MATRIX COMPOSITES FOR BIOIMPLANT**” by **VIPUL SAXENA** has been carried out under supervision Prof. Vinay Kumar Singh and this work has not been submitted elsewhere for a degree.

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ANNEXURE-E

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**Date: 29 Dec 2021**

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**Date: 29/12/2021**

**Place: Varanasi**



**(Vipul Saxena)**

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## ABBREVIATIONS ANDSYMBOLS

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%-Percentage	
©-Copyright	XRD-X-ray diffraction SEM-Scanning
°C - Degree centigrade	electron microscopy EDS-Energy
$\alpha$ -Alpha	dispersive X-ray spectroscopy
$\beta$ -Beta	TEM- Transmission Electron Microscopy
$\gamma$ -Gama	HR-TEM-High Resolution Transmission Electron
$\Theta$ - Theta	Microscopy
$\Delta$ -Delta	FTIR- Fourier-transform infrared
$\mu\text{m}$ -Micrometer	Spectroscopy
mm-Millimeter	
nm-Nanometer	
cm- Centimeter	
Kg-Kilogram	
gm -Gram(s)	
m-Molar	
min-Minutes	
sec-Second	
h-Hour	
ev-Electron Volts	
$\text{Å}^0$ -Angustan	
$\rho$ -Density	

## PREFACE

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The basis for this research work originally comes from my passion for developing nearly mimic implant so that needy peoples may be benefited. As the world moves further into the faster life, the chances of accidents and health issues are very frequent .To meet out the recovery, our society should have right matched replacement of our bones and more organs and bio functional entities. Keeping this as motivation, firstly I have gone into quest that what are the current problems running with the bio implants especially in load bearing bone implants where metallic implant are currently used . By going through lot of literatures, I came to know certain drawbacks and limitation of currently used metallic implants which I have made my basis for research and here in my thesis, to best of my capabilities, I have tried to find out the solution of current drawbacks.

It has been found that currently Ti-6Al-4V alloy is being used in orthopedic implant due to its comparable greater compressive and tensile strength, yield strength, and high resistance to corrosion in biological environments. Although these have all greatly improved the quality of life with their introduction, but they still suffering from some drawback like high Young's modulus (110 GPa) as compared to cortical bones (5 GPa) and with the long term use, Al and V may cause allergic reaction and neurological disorders like Alzheimer's disease (14).High cost is also one of the constraint for economical point of view.

The current thesis deals with the study of titanium based various metal ceramic composite which may be potentially used for the load bearing bio implants. In this work, titanium and their alloys matrix are reinforced with the selective bioactive ceramics.

The entire thesis is divided into seven different chapters and the references are given at the end of each chapter.

**Chapter 1** comprises of general introduction about primarily used elements like titanium and biomaterials .The brief summary of these element is discussed along with current problems and objectives.

**Chapter 2** gives the brief about the literature of other researchers, their findings and some important properties of titanium with their application as bio implant .The challenges and remedies of metal bio-implants are also discussed.

**Chapter 3**, the detail of materials used, experimental setup, synthesis method testing and characterization techniques are discussed which have been employed to perform the works presented in the thesis,

**Chapter 4** describe the effect of reinforcing 1393B3 bioactive glass on the physical, mechanical, biological and corrosion properties of the biomedical composite in the matrix of alloy Ti-Si –Mn was investigated.

**Chapter 5** reported the attempt to find out the reinforced effect of S53P4 bioactive silicate glass in TI-Nb-Fe alloy matrix on the biomechanical, corrosion properties of composite.

**Chapter 6** deals with the different alloy matrix of ti i.e Ti-Mo-Fe and reinforcing the S53P4 bioactive glass in the that matrix to observe the structural ,biological ,corrosion and mechanical behavior of composite.

**Chapter 7** is the concluding chapter in which I have summarized the result obtain to reach on some conclusion