



Ain Shams University-Collage of Women  
(Arts, Science and Education)  
Physics Department

## **Development and Functionalizing Bioactive Glass Coatings on 316L Stainless Steel for Hard Tissue Implantation and Fixation**

Ph.D. Degree in Physics (Biophysics)

**By**  
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A Thesis Submitted To

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## English Abstract

“Development and Functionalizing Bioactive Glass Coatings on 316L Stainless Steel for Hard Tissue Implantation and Fixation”

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The present work was essentially concerned with an improvement of the biocompatibility of 316L stainless steel (316L SS) by coating its surface by bioactive borate glass or silicate-based bioactive glass/chitosan composite layers using electrophoretic deposition (EPD) technique. Suspension of glass particles in double distilled water was used in this study as a coating suspension. The EPD parameters such as pH, applied voltage, glass concentration and time were optimized. The obtained coated substrates were investigated using FT-IR, X-ray diffraction and SEM/EDX analyses, as well as, the wettability and roughness were investigated. Additionally, the *in vitro* biodegradation was compared by applying biochemical and electrochemical corrosion assessment of the developed glass coatings in two biological fluids, SBF and DMEM at body temperature (37 °C). The results showed that the optimum conditions applied for borate-based glass coating to obtain uniform, cracked-free and adhesive coatings were achieved at pH 7, voltage 35 V, 4 % w/v glass and 15 min deposition time. The optimum ones for composite coatings were attained at 20 V, deposition time of 5 min, 0.5 g/L polymer concentration and 6 g/L glass concentration. The resulted coated 316L SS specimens demonstrated improved bioactivity and good corrosion resistance in both SBF and DMEM solutions at 37 °C using potentiodynamic polarization (PDP) technique.

### Keywords

Borate glass, bioactive glass, composite, coating, electrophoretic deposition, antimicrobial coating

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**Dedicated to soul of my father  
and my mother**

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