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

Zainab Mohammad Ibrahim Al-Rashidy

A Thesis Submitted To

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

Under the Supervision of

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English Abstract

"Development and Functionalizing Bioactive Glass Coatings on 316L Stainless Steel for Hard Tissue Implantation and Fixation"
Refractories and Ceramics Department, National Research Centre, Cairo, Egypt.

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 ^{o}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 ^{o}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

Contents

List of Figures

List of Tables