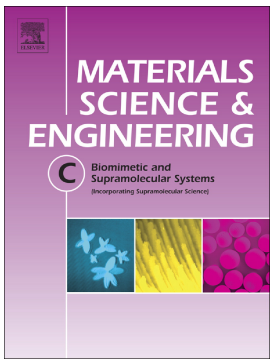

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Synthesis, characterization and cytocompatibility assessment of hydroxyapatite-polypyrrole composite coating synthesized through pulsed reverse electrochemical deposition

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Abstract:

Composite coating of hydroxyapatite-polypyrrole is synthesized with the help of pulsed reverse electrochemical deposition method from aqueous bath through in-situ formation and co-deposition of both phases simultaneously over metallic stainless steel surface. The inter phase bonding along with surface energy variation and morphology is tuned with the help of deposition current density, deposition time and reverse duty cycle. Hydroxyapatite (HA) lattice exhibits unidirectional growth along the highest atomic plane of <111> parallel to the coating surface. Different kind of deposited hydroxyapatite structures, namely lamellar and spherical particle scaffold, are observed at moderate and high current densities respectively together with the incorporation of polypyrrole (PPy) phase in between. Pyrrole ring stretching and bond strengthening represent the bonding with hydroxyapatite lattice, which in turn helps to increase the overall corrosion resistance of composite coating by ten fold as compared to bare PPY coating. The coating deposited with moderate current density (10 mA/cm^2) seems to be the optimum one regarding the faster-interconnected growth of MG63 cells over the coating surface along with highest corrosion resistance and anodic passivation capability. Presence of sub-micron level ceramic hydroxyapatite scaffold along with polymer filler material makes this composite biocompatible coating as a potential candidate to use over the load bearing metallic implant surfaces due to its sufficient elasticity along with superior toughness.

Keyword: Polypyrrole; hydroxyapatite; composite coating; pulsed reverse electrochemical-deposition; biocompatible coating; load bearing implant

1. Introduction:

On account of high mechanical strength, corrosion resistance and excellent process ability, metallic implants are the most preferred materials for orthopedic and dental implantation applications. Although the significant drawbacks with the metallic implants on the long-term basis are corrosion and subsequent metal particles removal from outer interface surfaces under contact with corrosive body fluid. The local pitting is further expedited with the heterogeneous structure of most metal alloys. This local corrosion leads to the release of metal ions or particles in surrounding live