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BIOACTIVE COATINGS AND CEMENTS AS BIOMEDICAL MATERIALS FOR ORTHOPAEDIC AND DENTAL SURGICAL IMPLANT APPLICATIONS

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Biomaterials are materials projected to interact with biological organisms, their interaction being a focus point of multidisciplinary research. The appropriate design of biomaterials for implants is a key factor for their long term stability. Due to the trend in demographics towards older population, there is currently a dramatic increase in the use of implants, but along with the benefits there is a high probability risk of infections caused by bacteria that attach to the implant surface and often form biofilms. According to clinicians, approximately 50% of implants fail during the first 5 years after implantation due to bacterial infection possibly acquired during surgery. For this reason, a special focus in the field of biomaterial science is dedicated to the design of new biomaterials with antibacterial and other functional properties. The application of Titanium (Ti) and its alloys as biomedical implants has dramatically increased in the last years due to their excellent biocompatibility, corrosion resistant and outstanding mechanical characteristics. To improve their performance, the Ti implants are coated with materials releasing Cu^{2+}, Zn^{2+} or Ag^{+} ions, with the scope to assure antibacterial characteristics and provide better long-term reliability. As promising biodegradable implant materials, Magnesium (Mg) alloys are studied in this work. However, their fast corrosion is a problematic issue. The properties of Mg alloys can be improved by applying protective coatings to control the degradation. In this study, bioactive glass and calcium phosphate coatings are studied as coating materials. Ion substituted calcium phosphate cements are also investigated in this work. They can endow cements with a broad range of specific functional properties, from antibacterial to magnetic one. Here the recent results obtained for several novel compositions of ion substituted calcium phosphate cements will be reported. In vitro bioactivity and cell tests results will be demonstrated. Present study suggests that novel nanostructured materials can be particularly relevant for new strategies in tissue replacement and regeneration, ensuring required structural, chemical, morphological and mechanical properties, improving osseointegration of dental and orthopaedic medical implants and providing a controlled release of active principles.