Structure and Properties of Electrodeposited Composite Metallic Coatings

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Abstract

The present PhD thesis primarily aims to study and develop composite metallic coatings obtained by electrodeposition, with enhanced functional properties tailored to the current demands of advanced engineering. The research focuses on the fabrication of high-performance layers in terms of durability, corrosion protection, mechanical and electrical behavior, as well as surface functionalization under critical conditions, such as corrosive or biologically active environments.
In line with the proposed objectives, this PhD thesis brings significant scientific and technological contributions in the following areas: optimization of the electrodeposition process to obtain composite coatings with superior corrosion resistance in aggressive environments; improvement of mechanical properties by increasing hardness and strength for use under severe industrial conditions; ensuring excellent adhesion to the substrate and eliminating surface defects, which are essential for operational reliability; integration of antibacterial properties, relevant for biomedical applications and biologically risky environments; development of multifunctional surfaces with potential applications in advanced industries such as aerospace, automotive, energy, electronics, and biomedical fields; and the creation of a modern, sustainable technological platform compatible with current industrial requirements.
Through its multidisciplinary approach and practical orientation, the PhD thesis contributes to the advancement of knowledge in the field of functional materials and provides viable technological solutions for applications in demanding environments, supporting the transition toward more efficient and industry-adapted processes.