Structural and Functional Characterization of electrodeposited Ni/Graphene nanocomposite coatings

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Abstract

The process of electrodepositing metals and alloys holds widespread significance and is applied across various fields [1]. Hard Chromium (HC) electroplated coatings have dominated the surface treatment industry for almost 100 years; however, the manufacturing of HC coatings requires the use of hexavalent chromium (Cr^{6+}) compounds which are classified as carcinogens and mutagens and are therefore restricted under REACH [2]. Electrodeposition of nickel-based nanocomposites exhibits remarkable improvements in their overall properties and offers a safer and more sustainable alternative compared to HC. This study focuses on the development of Ni-matrix nanocomposite coatings, utilizing graphene as a reinforcing agent. Graphene shows excellent electronic, optical, and self-lubricating properties, which render it highly valuable across various industries such as electronics, aerospace, chemicals, automotive, energy, and medical applications [3]. Our work examines the impact of different surfactants, pulse plating with different duty cycles and different graphene concentrations on the structure, morphology, and properties of the produced Ni-graphene nanocomposite coatings. The properties of the coatings were examined via SEM-EDS, XRD, contact angle, Raman spectroscopy, Optical microscopy, Taber abrasion test and Vickers Microhardness.

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Keywords Nickel Electroplating, Nanocomposite coatings, Graphene reinforcement

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