Wear and Adhesive Performance Investigation On Co-Ni-Fe Coated Mild Steel

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ABSTRACT

Wear and corrosion aspects in material are the main concern in any industrial sectors. Co-Ni-Fe coating can be fabricated by using electrodeposition to produce nanocrystalline materials which exhibit unique properties compared to the microcrystalline counterparts. This study involved the preparation of Co-Ni-Fe coated mild steel by using optimum parameters from previous research. The specimens undergo the phase and element characterization such as X-Ray Diffraction (XRD), scanning electron microscopy (SEM) and Energy-dispersive X-ray spectroscopy (EDX). The surface roughness of the specimen was evaluated before and after the slurry erosion test. The slurry erosion test was carried out in three different speeds which were 500, 1000 and 1500 RPM for 12 hours at 2 hours interval. The pull off load using epoxy adhesive was applied until the failure of the coating. EDX and XRD analysis revealed the Co-Ni-Fe phase without other impurities. At 500 RPM, there was no significant weight loss. At 1000 and 1500 RPM, the weight loss was increased as the time increased. The surface roughness of the coating was increased from 0.159μm to 0.234 μm after wear test rotated at 1500 RPM. In term of adhesion, the pull off test showed the coating did not removed from the substrate. This evident that strong adhesion of the coating contacted with the substrate. In fact, Co-Ni-Fe coating having average thickness of 9.12 μm in term of wear and adhesion can be a significant contribution to industries such as marine, manufacturing and oil and gas sectors where it can enhance the material life span at the same time protect the mild steel substrate from wear attacked.

CHAPTER 1

INTRODUCTION

1.1 Research Background

Co-Ni-Fe nanocrystalline is the combination of three elements that consists of cobalt, nickel and ferrous alloy to create a good corrosion resistant material. In term of its structure, nanocrystaline is said to be one of the best structure that has superior and excellent performance in mechanical, chemical and physical properties[1]. In recent years, electrodeposited cobalt-iron (CoFe) elements alloys gain so much attention in the application of micro electrochemical systems (MEMS) and protective coatings due to their high saturation magnetic flux density and high Curie temperature [2].

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