Mehry Fattah et al., J Nanomater Mol Nanotechnol 2018, Volume 7
DOI: 10.4172/2324-8777-C7-038

Microstructure and surface properties study of plasma nitrided aisi 4140 low alloy steel at different temperatures

Mehry Fattah[1,2], **Farzad Mahboubi**[2] and **Sylvie Morin**[1]
[1]York University, Canada
[2] Amirkabir University, Iran

In this paper, the influence of plasma nitriding and treatment temperature on the corrosion and hardness properties, microstructure and composition of AISI 4140 low alloy steel was investigated. Plasma nitriding treatments carried out in a gas mixture of 85% N_2-15% H_2, for 5 h at a chamber pressure of 4 mbar at different treatment temperatures varying from 520 to 620°C. Optical microscopy, scanning electron microscopy, X-ray diffraction, hardness and microhardness measurements and potentiodynamic polarization technique in 3.5% NaCl solution, was used to study the plasma nitrided low alloy steel. The results revealed that plasma nitriding at temperatures between 520 and 570°C can produce a ε phase dominant compound layer which is supported by a diffusion zone. With increasing the treatment temperature from 570 to 620°C, γ′ phase appeared. The thickness of the compound layer and diffusion zone increased with increasing the treatment temperature. The thickest compound layer was produced in the sample was treated at 620°C, composed of two outer and inner layers with different microstructures and compositions and the maximum amount of nitride phases was detected at the depth of 20- 35μm from the surface. The hardness of the surface remarkably improved after plasma nitriding and reached up to a maximum of 945 HV0.05 at 520°C which is almost 5 times higher than of the untreated sample. Corrosion resistance increased after plasma nitriding at 520°C and continued to increase with increasing the treatment temperature to 545°C. With further increase of temperature from 545°C to 620°C, corrosion resistance decreased to the amount of the untreated sample. The sample treated at 545°C showed the most improved corrosion resistance while simultaneously attained surface hardness as high as about 4 times of the untreated sample.

Biography

Mehry Fattah is a researcher and engineer who has the experience of working within academia and industry on surface engineering, corrosion, and coatings for 9 years. She received her Ph.D. and MSc from Amirkabir University in Metallurgical Engineering (University of Toronto Canadian Accreditation Equivalency). She has successfully proposed a corrosion model that shows how microstructure and composition affect the corrosion mechanism, which leads to lower cost and more efficient solutions to protect the surface deterioration through general and pitting corrosion. She conducted cathodic protection designs which resulted in increasing lifespan and saving money in Oil and Gas industry. She has conference and ISI papers published as the result of her works. She enjoys facing new challenges and forging ahead to find the solutions under tight time frames while inspiring team members.

mefattah@gmail.com

Notes: