Electrochemical Corrosion and Wear Behavior of an Ultra-thin DLC Film Deposited on Different Annealing Ni-P Layers on Al-Mg Alloy in NaCl Solution

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doi: 10.20964/2016.07.06

Received: 26 March 2016 / Accepted: 8 May 2016 / Published: 4 June 2016

This study evaluated the electrochemical corrosion and wear behavior of an ultra-thin diamond-like carbon film on various annealing electroless Ni-P coatings on an Al-Mg alloy media plank in 3.5wt.% NaCl solution. The annealing process was performed at different temperatures from 230°C to 280°C. The results indicated that annealing increased the hardness of electroless Ni-P coatings to an extent that increased with annealing temperature by causing the precipitation of Ni₃P, and this further resulting that the electrochemical corrosion resistance of electroless Ni-P coatings fell as the annealing temperature increased. Annealing electroless Ni-P coatings on which were deposited a diamond-like carbon film increased their hardness to an extent that increased with annealing temperature, but the diamond-like carbon film did not increase hardness when the annealing temperature was 280°C. Up to this temperature, annealing was more effective than depositing an ultra-thin diamond-like carbon film in strengthening the electroless Ni-P coatings. The results of the wear corrosion test demonstrated that depositing an ultra- thin diamond-like carbon film on electroless Ni-P coatings, those had been annealed at low temperature improved their wear corrosion resistance. However, the Ni-P coatings that was annealed at high temperature of 280°C and was covered by a diamond-like carbon ultra-thin film exhibited significantly wear corrosion failure. The wear corrosion failure was attributed to the fact that increasing the annealing temperature increased the hardness of the Ni-P coating while weakening the adhesion of the hard diamond-like carbon film on it.

Keywords: Electroless; Annealing; Diamond-like carbon; Wear corrosion

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