Corrosion behavior of zn-al layered double hydroxide superhydrophobic films directly grown on aluminum

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Superhydrophobic surfaces with contact angles over 150° and contact angle hysteresis under 10° have aroused attention because of the potential applications in self-cleaning and anticorrosion coatings. The corrosion resistance comes from the permeation of ions into the metallic surface that can be minimized by the air pockets formed on the solid-liquid interface [1].

Layered double hydroxydes (LDHs) are brucite-like materials charged positively layers with anions interlayers wich are superhydrophilic micro-nanostructure that can be transformed into a superhydrophobic one after treated by a low energy surface agent like saturated fatty acid [2].

In this work, plates of 1100 aluminum and 6061 aluminum alloy (20x20x2mm^3) were mechanically polished by 600# and 1200# sanding papers and ultrasonically cleaned in acetone for 10 minutes and after in isopropyl alcohol for the same time. Subsequently, the plates were immersed into a solution of 0,1M of $Zn(NO_3)_2.6H_20$ in distillated water with 4 mL of ammonia and then heated at 70°C for 3h, then immersed in a 1 wt% ethanol solution of stearic acid for 90 minutes and dried at 80°C for 1h.

The resulting microstructure of the films was observed by SEM. Polarization curves were produced when the plates were immersed in 3,5%wt NaCl solution at room temperature.

Afterwards, both aluminum plates showed superhydrophobicity. The Zn-Al LDH films showed curved platelets and flower-like structures. The corrosion density for the uncoated 1100 and 6061 aluminum alloys were 3.7 and 8.4 µA/cm^2, respectively. For the same coated samples the corrosion densities were almost one order of magnitude less: 0.33 and 0.45 µA/cm^2 for 1100 and 6061 alloys, which demonstrate the better corrosion behavior of the treated samples.

[1] Zheng, S. et al. Materials Design 93 (2016) 261-270

[2] Guo, X. et al. Chem. Commun., 46 (2010) 5197-5210