World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:11, No:05, 2017

Characterization of AlOOH Film Containing Mg-Al Layered Double Hydroxide Prepared on Al Alloy by Steam Coating

Authors : Ai Serizawa, Kotaro Mori, Takahiro Ishizaki

Abstract : Al alloys have been used as advanced structural materials in automobile and railway industries because of excellent physical and mechanical properties such as low density, good heat conductivity, and high specific strength. Their low corrosion resistance, however, limits their use in the corrosive environment. To improve the corrosion resistance of the Al alloys, the development of a novel coating technology has been highly desirable. Chemical conversion methods using layered double hydroxide (LDH) have attracted much attention because the LDH can suppress corrosion reaction due to their trapping ability of corrosive anions such as Cl- between layers. In this presentation, we report on a novel preparation method of AlOOH film containing Mg-Al layered double hydroxide (LDH) on Al alloy by steam coating. The corrosion resistance of the composite film including LDH was especially focused. Al-Mg-Si alloy was used as the substrate. The substrates were ultrasonically cleaned in ethanol for 10 min. The cleaned substrates were set in the autoclave with a 100 mL capacity. 20 ml of ultrapure water was located at the bottom of the autoclave to produce steam. The autoclave was heated up to a temperature of 100 to 200 °C, and then held at this temperature for up to 48 h, and was subsequently cooled naturally to room temperature, resulting in the formation of anticorrosive films on Al alloys. The resultant films were characterized by XRD, FT-IR, FE-SEM and electrochemical measurements. FE-SEM image of film surface treated at 180 °C for 48 h demonstrated that needle-like nanostructure was densely formed on the surface. XRD patterns revealed that the film formed on the Al alloys by steam coating was composed of crystal AlOOH and Mg-Al LDH. The corrosion resistance of the film was evaluated using electrochemical measurements. The potentiodynamic polarization curves of the film coated and uncoated substrates of Al-Mg-Si alloy after immersion in the 5 wt% NaCl aqueous solution for 30 min revealed that the corrosion current density, jcorr, of the film coated sample decreased by more than two orders of magnitude as compared to the uncoated sample, indicating that the corrosion resistance of the substrates of Al-Mg-Si alloy were improved by the formation of the anticorrosive film via steam coating.

Keywords : aluminum alloy, boehmite, corrosion resistance, steam process
Conference Title : ICAM 2017 : International Conference on Advanced Materials
Conference Location : Singapore, Singapore
Conference Dates : May 04-05, 2017