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Improvement of Environmental Hydrogen Embrittlement Resistance in High-strength Aluminum Alloys by means of Surface Modification

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7075-T6 aluminum alloys (Al-Zn-Mg alloys) are known to show high sensitivity for hydrogen embrittlement. It has been reported that the ductility of this alloy is reduced by breaking the oxide film during plastic deformation owing to the reaction of hydrogen generation between new aluminum surface and water vapor in the environment. In this study, plating was performed to prevent the exposure of the raw aluminum surface in the plastic deformation. Fig.1 shows the effect of surface treatment of Al-Zn-Mg base alloys on environmental hydrogen embrittle sensitivity. It was found that electrolytic Zn plating is effectively able to suppress the environmental hydrogen embrittlement owing to the suppression of the chemical reaction between the alloy surface without oxide film and water vapor in the testing environment.

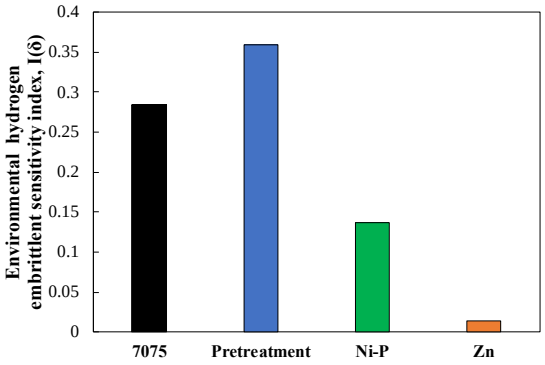

Fig. 1 Environmental hydrogen embrittlement sensitivity index in the different surface conditions.

Fig.2 shows the macroscopic images of the surface after the SSRT tested under wet air contions. Part of breaking of Ni-P plating layer was obvious when the Al-Zn-Mg alloy was plastically deformed (Fig.2(a)). In contrast, Zn plating surface deformed togher with original Al-Zn-Mg alloy layers (Fig.2(b)). The difference of deformed surface between Ni-P plating and Zn plating could lead to the difference of environmental hydrogen embrittlement sensitivity of Al-Zn-Mg base alloys.

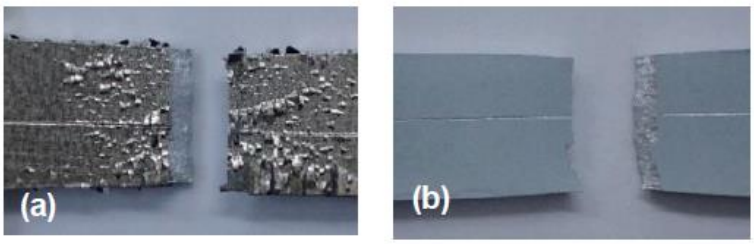

Fig. 2 Macroscopic images of the surface after the SSRT (Wet). (a)Ni-P plating, (b) Zn plating.