Anti-corrosion study of silane/graphene film on AA-2024 alluminum alloy

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Abstract

A γ-(2,3-epoxypropoxy) propyltrimethoxy-silane/graphene (GPTMS/rGO) coating on AA-2024 aluminum alloy was prepared by immersing the aluminium alloy sample in a silane/graphene oxide solution and curing in oven at 180 ℃. Silanol groups were grafted onto graphene oxide sheets during hydrolysis. The graphene oxide was stacked layer by layer through silanol groups. The process of the coating was concluded as shown in Figure1. The laminate structure of graphene increased the hardness and declined the brittleness over 200 ℃. The GPTMS/rGO coating showed good corrosion resistance. In 3.5% NaCl solution the anodic current density of the aluminum alloy sample with GPTMS/rGO coating was reduced by several orders of magnitude compared with those of bare aluminum alloy or the sample with reduced graphene film. The anti-corrosion property of the hybrid silane coating was enhanced by the addition of small amount of fluorosilane. The modified coating not only shows lower corrosion rate in neutral solution but also in the acidic and alkaline NaCl solutions. The hydrophobic fluorosilane increased water contact angle of the coating surface from 68° to 113°, and changed the stacking structure of graphene in the film as shown in Figure 2. The higher crosslink degree and less interfaces promoted the barrier property of the coating against aggressive ions.

References

[1] D.Q. Zhu, W. J. V. Ooij, J. Adhes. Sci. Technol. 16 (2002) 1235-1260.
[2] P.H. Suegama, H.G.D. Melo, A.A.C. Recco, et al., Surf. Coat. Technol. 202 (2008) 2850-2858.
[3] B. Ramezanzadeh, E. Ghasemi, M. Mahdavian, E. Changizi, et al., Carbon 93 (2015) 555-573.
[4] W. He, L. Zhu, H. Chen, et al., Appl. Surf. Sci. 279 (2013) 416-423

Figures

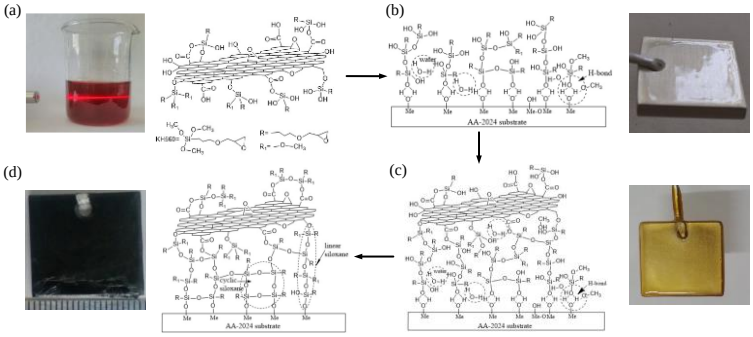

Figure 1: Preparation process of GPTMS/rGO coating

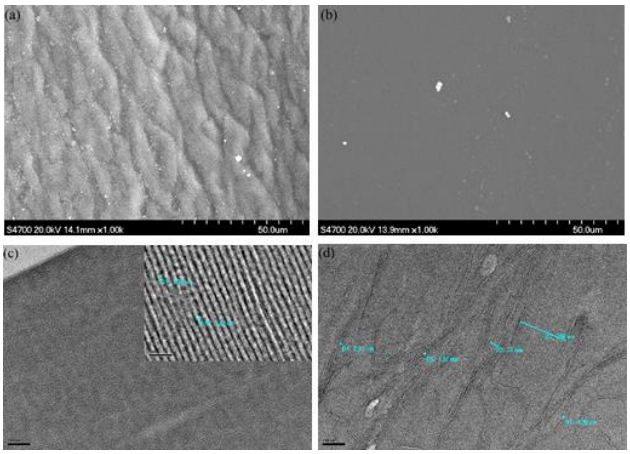

Figure 2: Morphology and micro structure of the modified silane graphene film