A Comparative Study on Zn and Zn-Y Coatings on 42CrMo Steel by Pack Cementation Process

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Zn and Zn-Y coatings on 42CrMo steel were prepared by pack cementation process at 360°C, 370°C, 380°C, 390°C and 400°C for 4 h, respectively. The purpose of this work was to comparatively study the differences on the microstructure and corrosion behavior between the two coatings. The relationship between the coating thickness and the temperature followed the linear rule. The Zn coating was continuous and had a single-layer structure. The Zn-Y coating exhibited a similar structure to the Zn-Fe coating. The Zn-Fe coating was a layer of Fe-Zn intermetallic compounds with increasing $\text{Fe}_3\text{Zn}_{10}$ concentration. YZn_5 was formed with the addition of Y. The effect of Y addition on the microstructure and corrosion behavior of the Zn coating was discussed. The thickness of the Zn-Y coating was thicker than that of the Zn coating. The activation energy for the formation of the coating decreased with the addition of Y. The concentration of $\text{Fe}_3\text{Zn}_{10}$ phase in the Zn-Y coating was slightly higher than that in the Zn coating, which suggested that the addition of Y promoted the formation of the $\text{Fe}_3\text{Zn}_{10}$ phase. The immersion test showed that the addition of Y could improve the ability of the coating to resist the penetration of Cl^- and O_2 .

Keywords: Zn; Pack cementation; Y; Microstructure; Corrosion

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