

The preparation of ZrO_2 -containing oxide layers on Mg alloy prepared by two step plasma electrolytic oxidation

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ZrO_2 -containing oxide layers were prepared on AZ31 magnesium alloy by plasma electrolytic oxidation (PEO) process in single and two step treatment. Surface morphology revealed that in contrast to the coatings prepared by the single step PEO method, almost all of the surface pores had been filled with zirconium compounds using the two step PEO method. A rather high density of micro-pores with different sizes was visible as black contrast holes on the surface oxide layer using the single step treatment. In fact, there were many residual discharging channels on the surface oxide layer. On the other hand, the open porosity of the oxide layer prepared by the two step PEO method was significantly low. Besides, the coating could be separated into two parts as a pancake like structure and small particles.

The cross-sectional SEM images indicated the remarkable difference between the oxide layer prepared by the single and the two step treatments. The coating prepared in the single step technique was porous. Whereas, the coating produced using the two step technique was compact and had a relatively uniform thickness throughout. In addition, the EDX results revealed that the coating prepared by the single step method contained 13.6 At% zirconium and 34.49 At% magnesium while the coating prepared by the two step process contained 37.46 At% zirconium and 12.58 At% magnesium. Because of high zirconium oxide content and denser microstructure, oxide layers obtained with the two step process coatings exhibited significantly superior corrosion resistance properties compared to the single step process.

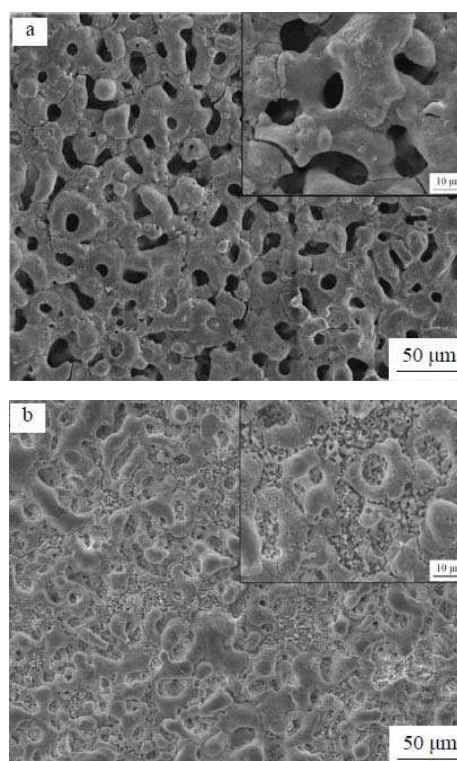


Fig.1. Surface SEM images of the coating prepared by (a) single step and (b) two step PEO process

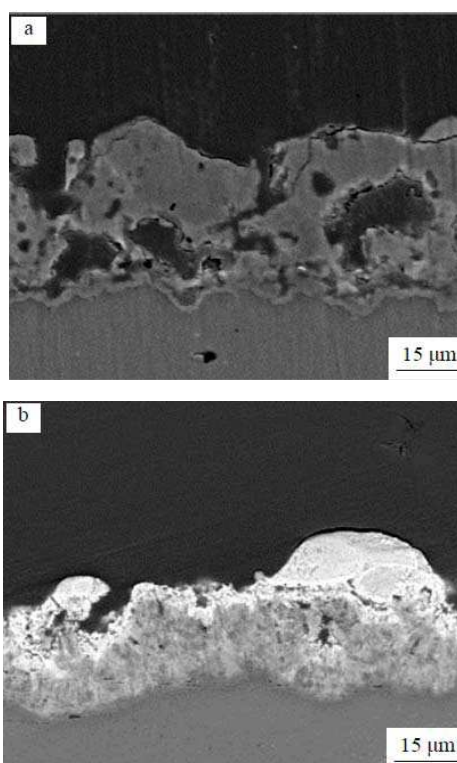


Fig.2. Cross-sectional images of the coating prepared by (a) single step and (b) two step PEO process