CORROSION RESISTANCE OF COATINGS PRODUCED BY MICRO ARC OXIDATION ON MAGNESIUM ALLOYS AND PHOSPHATE IONS EFFECT ITS STRUCTURE

Introduction

MAO (Micro Arc oxidation) method is a new surface treatment technique capable of forming well adhered nano structured ceramic coatings on valve metals such as Mg alloys, to improve their corrosion and wear resistances. This electrochemical technique involves the creation of an oxide layers analogous to anodized films with incorporation of species originating from both the substrate and the solution. However, alkaline electrolytes and special current regimes are used to work at potentials higher than the breakdown potentials of growing oxide films. Plasma discharges created during this process could result in high temperature and conversion of the growing coating into crystalline phase. In this method, coatings may be formed under various current regimes, including direct DC, periodic DC (unipolar and bipolar) and alternating AC current. InMAO technology, AC and periodic DC electrical regimes supply higher control over plasma chemical processes compared to DC regimes, thus creating a more uniform coating with less porosity. A two-layer structure is usually ascertained with a comparatively thinner and more compact barrier layer at the substrate-coating inter- face together with an outer porous region that is resulted due to the eruption of reaction products via the discharge channels. In the plasma electrolyte oxidation process, parameters including current density, voltage, frequency, duty cycle and electrolyte composition play significant roles on the coating's properties such as corrosion resistance . Therefore, investigating the optimization of these parameters is crucial step to obtain better coating properties. For this purpose, experimental design techniques (DOE) can be employed to findtheproperparameterstoachieverequiredproperties Taguchi method is a statistical and effectual technique of design of experiment (DoE) widely utilized in engineering analysis for optimization, process characterization and modeling, based on orthogonal array experiments. It consists of a special plan of experiments using an orthogonal array (OA) that helps in reducing variations in a process and determining the most significant function parameters . By means of this method, the optimum process condition can also be recognized to get rid of the traditional approach of changing one factor as holding the other factors constant (one factor at a time). In that old methodology, valuable information on combined effect of two or more factors may not be recognized. Taguchi employs a minimum possible matrix of combinations to improve quality of a system at minimum time and cost with more extensive results and information on the performance of a specified process. The results interpretation is based on a statistical quantify of performance via the signal to noise ratio *(S/N* or SNR) and the averages analysis. S/N analysis is a measure of the desired signal (mean) to the level of noise (standard deviation) which considers effectively the mean and variability encountered into account. According to the objective of experiments, the *S/N* ratio character can be separated into three categories for the response performance measuring; (i) smaller is better, (ii) larger is better and (iii) nominal is better.

Therefore, the aim of the present study is to achieve the optimum PEO process parameters condition on magnesium alloy for suitable corrosion performance, using Taguchi approach. Taguchi L18 orthogonal array technique with mixed level design with four parameters at three levels and one factoratsixlevelsiscarriedout.