Optimasi Waktu Plasma Electrolytic Oxidation untuk Meningkatkan Ketahanan Korosi dan Aus Paduan Aluminium AA7075-T651 = Time Optimization of Plasma Electrolysis Oxidation to Enhance Corrosion Resistance and Wear Resistance of AA7075-T651 Aluminum Alloy

Rifka Anggraeni, author

Abstrak

Logam ringan aluminium (Al) dan paduannya memiliki sifat mekanik yang cocok digunakan dalam industri penerbangan, perkapalan, dan otomotif. Proteksi terhadap permukaan logam Al diperlukan untuk meningkatkan ketahanan korosi dan aus. Plasma Electrolytic Oxidation (PEO) menghasilkanlapisan oksida tebal dan kristalin sehingga dapat meningkatkan ketahanan korosi dan ketahanan aus. Karakteristik mekanik dan korosi lapisan oksida hasil PEO sangat bergantung pada ketebalan dan morfologi lapisan yang ditentukan oleh waktu dan karakteristik plasma. Dalam penelitian ini, PEO dilakukan pada paduan Al seri 7075-T651 dengan menggunakan elektrolit campuran 30 g/lNa2SiO3, 30 g/l KOH, 30 g/l Na3PO4, dan 20 g/l TEA pada rapat arus konstan 200 A/m2dengan variasi waktu 10, 15, dan 20 menit. Lapisan PEO dikarakterisasi dengan menggunakan X-Ray Diffractometer (XRD) untuk menganalisis komposisi fasa kristal, Scanning Electron Microscopy-Energy Dispersive x-ray Spectroscopy (SEM-EDS) untuk menganalisis morfologi permukaan dan komposisi unsur. Perilaku korosi pada sampel dievaluasi melalui uji elektrokimia, yaitu Open Circuit Potential (OCP), Electrochemical Impedence Spectroscopy (EIS), dan juga Potentiodynamic Polarization (PDP). Sifat mekanik lapisan PEO diuji dengan metode Vickers microhardness, dan ketahanan aus diuji menggunakan metode Ogoshi. Unsur P, Si, O merupakan lapisan perlindungan terhadap korosi semakin meningkat seiring berjalannya waktu. Hasil XRD menunjukkan adanya lapisan Al2O3, SiO2, dan AlPO4. Hasil uji elektrokimia PDP dan EIS menunjukkan bahwa PEO 15 menit menunjukkan kinerja korosi yang paling baik, memiliki rapat arus korosi terendah sebesar 1,20 × 10-7 A.cm2 dan hambatan tertinggi sebesar 706,8 .cm2 dan 1,65 × 104 .cm2. Tetapi, uji mekanik menunjukkan bahwa PEO 15 menitmemiliki tingkat keausan yang tinggi sebesar 20,8 mm3/mm dan kekerasan sebesar 143 HV. Sedangkan PEO 20 menit nilai keausan lebih rendah sekitar 8 mm3/mm dan kekerasan sebesar 159,4 HV serta sudut kontak sebesar 78.

.....The lightweight metal aluminum (Al) and its alloys exhibit mechanical properties suitable for use in the aerospace, shipping, and automotive sectors. Surface protection of Al metal is necessary to enhance corrosion and wear resistance. Plasma Electrolysis Oxidation (PEO) produces thick and crystalline oxide layers, thus improving high corrosion resistance and high wear resistance. The mechanical and corrosion characteristics of PEO oxide layers greatly depend on the thickness and morphology of the layers determined by time and plasma characteristics. In this study, PEO was performed on 7075-T651 series Al alloy using a mixed electrolyte of 30 g/l Na2SiO3, 30 g/l KOH, 30 g/l Na3PO4, and 20 g/l TEA at a constant current density of 200 A/m2 with time variations of 10, 15, and 20 minutes. The PEO layers were characterized using X-Ray Diffractometer (XRD) to analyze the crystal phase composition, Scanning Electron Microscopy-Energy Dispersive x-ray Spectroscopy (SEM-EDS) to analyze surface morphology and elemental composition. Corrosion behavior on the samples was evaluated through electrochemical tests, namely Open Circuit Potential (OCP), Electrochemical Impedance Spectroscopy (EIS), and

Potentiodynamic Polarization (PDP). The mechanical properties of PEO layers were tested using the Vickers microhardness method, and wear resistance was tested using the Ogoshi method. The protective layer against corrosion increases over time with elements P, Si, O. XRD results show the presence of Al2O3, SiO2, and AlPO4 layers. PDP and EIS electrochemical test results indicate that PEO for 15 minutes shows the best corrosion performance, with the lowest corrosion current density of 1.20 × 10-7 A.cm2 and the highest impedance of 706.8 .cm2 and 1,65 × 104 .cm2. However, mechanical tests show that the 15-minute PEO has a high wear rate of 20.8 mm3/mm and a hardness of 143 HV. Meanwhile, the 20-minute PEO has a lower wear rate of about 8 mm3/mm and a hardness of 159.4 HV, as well as a contact angle of 78.