Perilaku ketahanan korosi lapisan oksida alumina yang ditumbuhkan dengan metode plasma electrolytic oxidation pada paduan aluminium seri 1100 dan 7075-T735 = Corrosion resistance behavior of aluminum oxide layers grown by plasma electrolytic oxidation method in aluminium alloy 1100 and 7075-T735 series

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Abstrak

Paduan aluminium banyak digunakan dalam berbagai aplikasi, terutama di bidang otomotif dan penerbangan karena keunggulannya. Aluminium bersifat ringan, kekuatan tinggi, serta densitas rendah. Namun, sifat mekanik dan ketahanan korosinya perlu ditingkatkan. Plasma Electrolytic Oxidation (PEO) adalah metode terbaru untuk melindungi aluminium dengan menumbuhkan lapisan keramik oksida pada permukaannya. Dalam penelitian ini, proses PEO dilakukan pada paduan aluminium seri 1100 dan 7075-T735 dengan elektrolit campuran 30 g/Na2SiO3, 30 g/l KOH, dan 20 g/l TEA dengan rapat arus 200 A/m2 selama 6 menit. Kedua jenis seri paduan tersebut digunakan sebagai pembanding dalam proses PEO dimana seri 1100 tergolong Al murni sedangkan seri 7075 memiliki banyak presipitat. Hasil uji korosi dengan menggunakan uji elektrokimia menunjukkan bahwa sampel AA7075-T735 berlapis PEO memiliki ketahanan korosi yang paling baik. Hal ini dibuktikan dengan nilai rapat arus korosi (icorr) terendah, yaitu mencapai 5,91x10-7 A.cm-2 dan loop kapasitif yang paling besar serta ketidakhadiran loop induktif pada kurva Nyquist. Dari uji hilang berat juga diperoleh hasil rata-rata hilang berat yang lebih rendah pada sampel AA7075-T735 dibandingkan dengan AA1100. Ketahanan korosi sampel berlapis PEO mengikuti perilaku substratnya. Sampel AA1100 mengalami degradasi coating yang lebih dominan daripada AA7075-T735. Hal ini berkaitan dengan porositas dan kepadatan lapisan PEO pada kedua sampel.

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Aluminum alloys are widely used in various applications, especially in the automotive and aviation industries, due to their advantages. Aluminum is lightweight, has high strength, and low density. However, its mechanical properties and corrosion resistance need improvement. Plasma Electrolytic Oxidation (PEO) is the latest method used to protect aluminum by growing a ceramic oxide layer on its surface. In this study, the PEO process was applied to aluminum alloys of series 1100 and 7075-T735 using an electrolyte mixture of 30 g/L Na2SiO3, 30 g/L KOH, and 20 g/L TEA with a current density of 200 A/m2 for 6 minutes. Both alloy series were used as comparators in the PEO process, with series 1100 being classified as pure Al, while series 7075 has numerous precipitates. Corrosion tests using electrochemical analysis showed that the PEO-coated AA7075-T735 sample exhibited the best corrosion resistance. This was evident from its lowest corrosion current density (icorr) value, which reached 5.91x10-7 A.cm-2 , as well as the largest capacitive loop and the absence of an inductive loop in the Nyquist curve. Weight loss tests also indicated that the average weight loss was lower in the AA7075-T735 sample compared to AA1100. The corrosion resistance of the PEO-coated samples followed the behavior of their substrates. The AA1100 sample experienced more dominant coating degradation compared to AA7075-T735, which was related to the porosity and density of the PEO layer in both samples.