

ABSTRAK

PENGARUH VARIASI TEMPERATUR AGING TERHADAP EVOLUSI STRUKTUR MIKRO, KEKERASAN, DAN KETAHANAN KOROSI ALUMINIUM 6061 PADA LINGKUNGAN AIR LAUT BUATAN

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Aluminium 6061 merupakan salah satu paduan aluminium yang banyak digunakan karena memiliki kombinasi sifat mekanik dan ketahanan korosi yang baik. Namun, sifat tersebut sangat dipengaruhi oleh perlakuan panas, khususnya proses *artificial aging* yang mengontrol evolusi struktur mikro melalui pembentukan presipitat. Variasi temperatur *aging* dapat menyebabkan perubahan ukuran, distribusi, dan komposisi presipitat seperti fase β (Mg_2Si) dan fase kompleks Q yang berpengaruh langsung terhadap kekerasan serta perilaku korosi material, terutama dalam lingkungan agresif seperti air laut buatan yang mengandung ion klorida (Cl^-). Penelitian ini bertujuan untuk menganalisis pengaruh variasi temperatur *aging* terhadap struktur mikro, kekerasan, dan ketahanan korosi aluminium 6061. Metode yang digunakan meliputi perlakuan *solution heat treatment* dengan temperatur $550^\circ C$ selama 2 jam lalu dilakukan *quenching* menggunakan media *dry ice*, kemudian dilanjutkan dengan proses *artificial aging* pada temperatur $180^\circ C$, $200^\circ C$, dan $220^\circ C$ selama 6 jam. Karakterisasi dilakukan menggunakan *Optical Microscope* (OM), SEM EDS *Mapping*, uji kekerasan Rockwell, serta uji korosi polarisasi potensiodinamik. Hasil penelitian menunjukkan bahwa temperatur *aging* berpengaruh signifikan terhadap sifat material. Kondisi $180^\circ C$ menghasilkan laju korosi terendah sebesar $1,01 \times 10^{-3}$ mm/year dengan struktur mikro yang homogen. Pada kondisi $200^\circ C$ diperoleh kekerasan maksimum (87,5 HRB) namun laju korosi tertinggi ($3,89 \times 10^{-3}$ mm/year) akibat peningkatan fase Q dan heterogenitas. Sementara itu, pada kondisi $220^\circ C$ terjadi *overaging* yang menyebabkan penurunan kekerasan dan sedikit penurunan laju korosi. Sehingga dari hasil tersebut, diperoleh temperatur *aging* optimum pada kondisi $180^\circ C$.

Kata kunci: *aging*, aluminium 6061, korosi, struktur mikro, fasa Q

ABSTRACT

THE INFLUENCE OF AGING TEMPERATURE VARIATIONS ON THE EVOLUTION OF MICROSTRUCTURE, HARDNESS, AND CORROSION RESISTANCE OF ALUMINIUM 6061 IN AN ARTIFICIAL SEAWATER ENVIRONMENT

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Aluminium 6061 is widely used due to its excellent combination of mechanical properties and corrosion resistance. However, these properties are strongly influenced by heat treatment, particularly artificial aging, which controls microstructural evolution through precipitate formation. Variations in aging temperature affect the size, distribution, and composition of precipitates such as β phase (Mg_2Si) and complex phase Q which in turn influence hardness and corrosion behavior, especially in aggressive environments such as artificial seawater containing chloride ions (Cl^-). This study aims to analyze the effect of aging temperature variations on the microstructure, hardness, and corrosion resistance of aluminium 6061. The method used includes solution heat treatment at $550^\circ C$ for 2 hours followed by quenching using dry ice as the cooling medium, and subsequently continued with artificial aging at temperatures of $180^\circ C$, $200^\circ C$, and $220^\circ C$ for 6 hours. Characterization was carried out using Optical Microscope (OM), SEM EDS Mapping, Rockwell hardness testing, and potentiodynamic polarization corrosion testing. The results show that aging temperature significantly affects the material properties. The condition at $180^\circ C$ produces the lowest corrosion rate of $1,01 \times 10^{-3}$ mm/year with a homogeneous microstructure. At $200^\circ C$, the maximum hardness (87.5 HRB) is achieved, but it also results in the highest corrosion rate ($3,89 \times 10^{-3}$ mm/year) due to the increased presence of Q phase and microstructural heterogeneity. Meanwhile, at $220^\circ C$ overaging occurs, leading to a decrease in hardness and a slight reduction in corrosion rate. Therefore, the optimum aging temperature is obtained at $180^\circ C$.

Keywords: aging, aluminium 6061, corrosion, microstructure, Q phase