

## ABSTRAK

### **THE EFFECT OF HOLDING TIME ARTIFICIAL AGING ON HARDNESS AND MICROSTRUCTURE OF Al-2024**

By:

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*This study aims to determine the effect of holding time artificial aging on the hardness and microstructure of Al-2024. This study used a specimen in the form of Aluminum 2024 series which was heat treated at a temperature of 500°C for 60 minutes, then quenched with a cooling medium in the form of water. Subsequently, it was reheated with variations in holding time, namely 3 hours, 5 hours and 7 hours with a temperature of 190°C. Then the specimen is slowly cooled to room temperature. The results of the chemical composition test using Spectromax showed the percentage of Al was 90.6% and Cu was 5.90%. The results of the hardness test using the Rockwell Hardness Tester obtained a hardness value without heat treatment which has a hardness value of 71.4 (HRB), a hardness value after quenching of 66.9 (HRB). The highest hardness value is found in heating with a holding time variation of 5 hours with a temperature of 190°C, the hardness value is 84.6 (HRB) where the hardness value at a holding time of 5 hours has increased by 8.48% from the hardness value of the material without heat treatment. Microstructure testing showed that the Al-Cu material after the artificial aging process at a holding time of 5 hours had a precipitate phase ( $\theta$ ) with a higher amount and the Al-Cu grain boundaries tended to be more dense and regular. This means that the material that has been treated with artificial aging has precipitated deposits or the formation of a second phase which causes the material to be harder and have better mechanical properties.*

*Keywords: aluminum 2024, artificial aging, hardness value and microstructure.*

## ABSTRAK

### **PENGARUH *HOLDING TIME ARTIFICIAL AGING* TERHADAP SIFAT KEKERASAN DAN STRUKTUR MIKRO Al-2024**

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Penelitian ini bertujuan untuk mengetahui pengaruh *holding time artificial aging* terhadap sifat kekerasan dan struktur mikro Al-2024. Penelitian ini menggunakan spesimen berupa Aluminium seri 2024 yang diberi perlakuan panas dengan suhu 500°C selama 60 menit, kemudian di *quenching* dengan media pendingin berupa air. Selanjutnya diberi perlakuan panas kembali dengan variasi *holding time* yakni 3 jam, 5 jam dan 7 jam dengan temperatur 190°C. Kemudian spesimen didinginkan secara lambat dengan suhu ruangan. Hasil uji komposisi kimia menggunakan *Spectromax* menunjukkan persentase Al sebesar 90,6% dan Cu sebesar 5,90%. Hasil uji kekerasan menggunakan *Rockwell Hardness Tester* didapatkan nilai kekerasan tanpa perlakuan panas yang memiliki nilai kekerasan sebesar 71,4 (HRB), nilai kekerasan setelah di *quenching* sebesar 66,9 (HRB). Nilai kekerasan tertinggi terdapat pada pemanasan dengan variasi *holding time* 5 jam dengan temperatur 190°C didapatkan nilai kekerasan sebesar 84,6 (HRB) dimana nilai kekerasan pada *holding time* 5 jam mengalami peningkatan sebesar 8,48% dari nilai kekerasan bahan tanpa perlakuan panas. Pengujian struktur mikro didapatkan hasil material Al-Cu setelah proses *artificial aging* pada *holding time* 5 jam memiliki fase presipitat ( $\theta$ ) dengan jumlah yang lebih banyak dan batas butir Al-Cu cenderung lebih rapat dan teratur. Hal ini berarti bahwa pada bahan yang mendapat perlakuan *artificial aging* terdapat endapan presipitat atau terbentuknya fasa kedua yang menjadi penyebab bahan tersebut lebih keras dan lebih baik sifat mekanisnya

Kata Kunci: aluminium 2024, *artificial aging*, nilai kekerasan dan struktur mikro