

ABSTRAK

Paduan aluminium-silikon (ADC12) banyak digunakan pada industri otomotif karena memiliki massa ringan, ketahanan korosi yang baik, dan kemampuan cor yang tinggi. Namun, paduan ini masih memiliki keterbatasan pada sifat mekanik, terutama kekerasan. Penelitian ini bertujuan untuk menganalisis pengaruh penambahan nikel (Ni) dan variasi ukuran *mesh* pasir silika terhadap sifat mekanik dan mikrostruktur paduan ADC12 menggunakan proses pengecoran *sand casting*. Variasi komposisi nikel yang digunakan sebesar 2%, 4%, dan 6% berat (g) dengan variasi ukuran *mesh* pasir silika 40, 60, dan 80. Pengujian yang dilakukan meliputi uji kekerasan *Vickers*, densitas, karakterisasi mikrostruktur menggunakan SEM-EDS, serta analisis statistik menggunakan *Two Way ANOVA*. Hasil penelitian menunjukkan bahwa peningkatan kadar nikel dan ukuran *mesh* pasir memberikan pengaruh signifikan terhadap peningkatan kekerasan paduan ADC12. Nilai kekerasan tertinggi diperoleh pada komposisi 6 wt% Ni dengan *mesh* 80 sebesar 338,63 HV, sedangkan nilai terendah pada komposisi 2 wt% Ni dengan *mesh* 40 sebesar 76,23 HV. Hasil SEM-EDS menunjukkan adanya pembentukan fasa *intermetalik* Al–Ni dan peningkatan densitas pada rentang 2,65–2,81 g/cm³. Hasil ANOVA menunjukkan bahwa faktor nikel memberikan pengaruh paling dominan terhadap perubahan kekerasan.

Kata kunci: ADC12, Nikel, *Mesh* Pasir Silika, *Sand Casting*, *Vickers*, SEM-EDS, *Density*.

ABSTRACT

Aluminum–silicon alloy (ADC12) is widely used in the automotive industry due to its lightweight properties, good corrosion resistance, and excellent castability. However, this alloy still has limitations in its mechanical properties, particularly hardness. This study aimed to analyze the effect of nickel (Ni) addition and silica sand mesh size variation on the mechanical properties and microstructure of ADC12 alloy using the sand casting process. The nickel compositions used were 2, 4, and 6 wt%, with silica sand mesh size variations of 40, 60, and 80 mesh. The tests conducted included Vickers hardness testing, density measurement, microstructural characterization using Scanning Electron Microscopy–Energy Dispersive X-ray Spectroscopy (SEM–EDS), and statistical analysis using Two-Way ANOVA. The results showed that increasing nickel content and sand mesh size had a significant effect on improving the hardness of ADC12 alloy. The highest hardness value was obtained at 6 wt% Ni with 80 mesh, reaching 338.63 HV, while the lowest value was obtained at 2 wt% Ni with 40 mesh, reaching 76.23 HV. SEM–EDS analysis indicated the formation of Al–Ni intermetallic phases and an increase in density within the range of 2.65–2.81 g/cm³. The ANOVA results revealed that the nickel factor had the most dominant influence on hardness variation.

Keywords: ADC12, Nickel, Silica Sand Mesh, Sand Casting, Vickers Hardness, SEM–EDS, Density.