INTISARI

Pengelasan merupakan proses penting dalam konstruksi kapal, namun berisiko menimbulkan distorsi dan perubahan sifat mekanik akibat perlakuan termal yang tidak terkendali. Penelitian ini bertujuan untuk membandingkan empat perlakuan termal terhadap hasil pengelasan baja ASTM A36 menggunakan metode *Flux-Cored Arc Welding* (FCAW), yang banyak digunakan dalam pembangunan struktur kapal.

Empat kondisi perlakuan diuji, yaitu tanpa perlakuan, *Preheat*-250℃, *Heat sink,* dan *Static Thermal Tensioning* (STT-200℃). Evaluasi dilakukan melalui pengukuran distorsi, pengamatan struktur mikro, pengujian kekerasan mikro Vickers, uji tarik, dan pengujian perambatan retak fatik menggunakan pendekatan kurva Paris (*da/dN* terhadap *ΔK*).

Hasil menunjukkan bahwa STT menghasilkan distorsi paling kecil dan struktur mikro paling seimbang dengan distribusi ferit batas butir dan bainit halus. *Preheat* memberikan keuletan terbaik dengan regangan tinggi dan umur fatik terpanjang. *Heat sink* menghasilkan kekerasan dan kekuatan tarik tertinggi, namun dengan laju perambatan retak paling cepat. Secara keseluruhan, STT-200℃ dinilai paling optimal karena memberikan keseimbangan antara kekuatan, keuletan, ketahanan retak, dan distorsi minimun, menjadikannya Solusi potensial untuk aplikasi pengelasan struktur kapal.

Kata kunci: FCAW; Distorsi; *Preheat*; *Heat sink*; *Static thermal tensioning*; Perambatan retak fatik; Kekuatan tarik; Baja ASTM A36

ABSTRACT

Welding is a crucial process in ship construction but poses risks of distortion and changes in mechanical properties due to uncontrolled thermal cycles. This study aims to compare four thermal treatments applied on ASTM A36 steel using the Flux-Cored Arc Welding (FCAW) method, which is widely used in shipbuilding.

Four treatment conditions were tested, namely: As-welded, Preheat-250°C, Heat Sink, and Static Thermal Tensioning (STT-200°C). The evaluation was conducted through tensile testing, and fatigue crack propagation analysis using the Paris Law curve approach (da/dN vs ΔK).

The results showed that STT produced the lowest distortion and the most balanced microstructure, with a uniform distribution of fine-grained ferrite and bainite. Preheating provided the best ductility with high elongation and the longest fatigue life. Heat sink yielded the highest hardness and tensile strength, but also exhibited the fastest crack growth rate. Overall, STT-200°C was found to be the most optimal treatment as it offers a balance of strength, ductility, fatigue resistance, and minimal distortion, making it promising solution for structural welding applications in shipbuilding.

Keywords: FCAW; Distortion; Preheat; Heat Sink; Static Thermal Tensioning; Fatigue Crack Growth Rate; Tensile Strength; ASTM A36 Steel