

ABSTRAK

ANALISIS KEKUATAN PALU BESI HASIL PENEMPAAN TRADISIONAL SETELAH PROSES OPTIMALISASI MATERIAL DAN PERLAKUAN PANAS

Penelitian ini bertujuan menganalisis kekuatan palu besi hasil penempaan tradisional setelah proses optimasi material dan perlakuan panas *tempering* pada suhu 550°C dengan variasi waktu 1, 2, dan 3 jam. Pengujian dilakukan terhadap nilai kekerasan *Rockwell*, dampak, dan struktur mikro. Hasil menunjukkan kekerasan *Rockwell* tertinggi terdapat pada palu tanpa *tempering* dan *tempering* 1 jam ($\pm 91,8$ HRB), sementara *tempering* 2–3 jam menurunkan kekerasan menjadi ± 88 HRB. Nilai dampak tertinggi juga terdapat pada *tempering* 1 jam, sedangkan variasi waktu lain memberikan nilai serapan energi yang relatif konstan. Struktur mikro tanpa *tempering* didominasi martensit kasar, sedangkan setelah *tempering* berkembang perlit dan ferit dengan martensit yang semakin halus. Kesimpulannya, *tempering* 1 jam pada suhu 550°C menjadi pilihan optimal untuk keseimbangan kekerasan dan ketangguhan pada palu tempa tradisional.

Kata kunci: Palu tempa, *Tempering*, Kekerasan *Rockwell*, Dampak, Struktur mikro.

ABSTRACT

ANALYSIS OF THE STRENGTH OF THE IRON HAMMER FROM TRADITIONAL FORGING AFTER THE PROCESS OF MATERIAL OPTIMIZATION AND HEAT TREATMENT

This study aims to analyze the strength of traditional forged iron hammers after the material optimization process and tempering heat treatment at 550°C with time variations of 1, 2, and 3 hours. Tests were performed on Rockwell hardness, impact, and microstructure values. The results showed that the highest Rockwell hardness was found in hammers without tempering and tempering 1 hour (± 91.8 HRB), while 2–3 hour *tempering* reduced hardness to ± 88 HRB. The highest impact value is also found in 1-hour tempering, while other time variations provide relatively constant energy absorption values. The microstructure without tempering is dominated by coarse martensite, while after tempering perlite and ferrite develop with increasingly fine martensite. In conclusion, 1 hour tempering at 550°C is the optimal choice for the balance of hardness and toughness in traditional forged hammers.

Keywords: Forged hammer, Tempering, Rockwell hardness, Impact, Microstructure.