

INTISARI

Wearing ring merupakan salah satu komponen penting pada turbin air PLTA yang berperan menjaga efisiensi aliran dan melindungi bagian utama turbin air dari keausan. Pada PLTA Bakaru, *wearing ring* yang mengalami penurunan performa akibat keausan yang terjadi secara terus-menerus selama beroperasi. Kondisi ini berpotensi mengurangi keandalan turbin dan meningkatkan risiko gangguan operasi. Perlakuan permukaan adalah salah satu metode untuk meningkatkan performa mekanis material. Penelitian ini bertujuan untuk mengkaji pengaruh durasi dan tekanan perlakuan permukaan *shot peening* terhadap perubahan sifat mekanis, ketahanan aus, dan ketahanan korosi material *stainless steel* 403 pada komponen *wearing ring* untuk aplikasi turbin air.

Stainless steel 403 adalah material yang digunakan sebagai spesimen uji pada penelitian ini, diambil dari sampel *wearing ring* pada komponen turbin air. Perlakuan permukaan yang dilakukan adalah *shot peening* dengan variasi durasi 0, 10, 20, dan 30 menit dikombinasikan dengan variasi tekanan kompresor sebesar 8 dan 12 bar. *Steel shot* dengan bahan *stainless steel* berbentuk bulat dengan diameter 0.6 mm ditembakkan pada jarak tembak 60 mm dan sudut penembakan 90° dari permukaan spesimen uji. Metode penelitian yang digunakan bersifat eksperimental, dengan pengujian meliputi uji komposisi kimia, uji tarik, pengamatan struktur mikro, uji kekerasan, uji keausan, dan uji korosi.

Hasil penelitian menunjukkan bahwa peningkatan durasi dan tekanan *shot peening* dapat meningkatkan kekerasan permukaan, ketahanan aus, dan ketahanan korosi material. Nilai kekerasan permukaan pada material meningkat dari 181,45 HVN sebelum perlakuan menjadi 233,91 HVN setelah perlakuan selama 30 menit pada tekanan 12 bar. Keausan spesifik menurun dari $1,14 \times 10^{-3} \text{ mm}^3/\text{kg.m}$ pada *raw material* menjadi $4,11 \times 10^{-5} \text{ mm}^3/\text{kg.m}$ setelah perlakuan shot peening selama 30 menit pada tekanan 12 bar. Laju korosi menurun dari 0,358 mpy menjadi 0,133 mpy setelah perlakuan shot peening selama 30 menit pada tekanan 12 bar.

Kata kunci : *Stainless steel, shot peening, kekerasan, aus, korosi, wearing ring*

ABSTRACT

The wearing ring is a critical component in hydroelectric power plant turbines, serving to maintain flow efficiency and protect the primary turbine components from wear. At the Bakaru Hydroelectric Power Plant, the wearing ring has experienced performance degradation due to continuous wear during long-term operation. This condition may reduce turbine reliability and increase the risk of operational failures. Surface treatment is one of the most effective approaches for improving the mechanical performance of engineering materials. This study aims to investigate the effects of shot peening duration and peening pressure on the mechanical properties, wear resistance, and corrosion resistance of SUS 403 stainless steel used as a wearing ring material for hydro turbine applications.

SUS 403 stainless steel, obtained from an actual wearing ring of a hydro turbine, was used as the test material in this study. The surface treatment was performed using the shot peening process with treatment durations of 0, 10, 20, and 30 minutes, combined with compressor pressures of 8 and 12 bar. Spherical stainless steel shots with a diameter of 0.6 mm were projected onto the specimen surface at a stand-off distance of 60 mm and an impingement angle of 90°. An experimental research approach was employed, incorporating chemical composition analysis, tensile testing, microstructural characterization, hardness testing, wear testing, and corrosion testing.

The results demonstrate that increasing the shot peening duration and pressure significantly enhances the surface hardness, wear resistance, and corrosion resistance of SUS 403 stainless steel. The surface hardness increased from 181.45 HVN for the untreated material to 233.91 HVN after shot peening for 30 minutes at a pressure of 12 bar. The specific wear decreased from $1.14 \times 10^{-3} \text{ mm}^3/(\text{kg}\cdot\text{m})$ for the untreated material to $4.11 \times 10^{-5} \text{ mm}^3/(\text{kg}\cdot\text{m})$ following shot peening under the same processing conditions. Likewise, the corrosion rate was reduced from 0.358 mpy to 0.133 mpy after shot peening for 30 minutes at 12 bar. These findings indicate that shot peening is an effective surface engineering technique for improving the mechanical and corrosion performance of AISI 403 stainless steel, thereby extending the service life and operational reliability of hydro turbine wearing rings.

Keywords : *Stainless steel, shot peening, hardness, wear, corrosion, wearing ring.*