

INTISARI

Penelitian ini bertujuan untuk menganalisis pengaruh jenis *bed material* terhadap laju abrasi (*erosion rate*) pada *wall tube boiler* tipe *Circulating Fluidized Bed* (CFB). Masalah abrasi pada *wall tube* menjadi penyebab utama kebocoran dan penurunan efisiensi operasi pada PLTU CFB di lingkungan PT PLN Nusantara Power. Dua jenis *bed material* yang diuji adalah *aluminium oxide* (Al_2O_3) dan silika (garnet), dengan variasi waktu *sandblasting* 2, 4, 6, 8, dan 10 menit, serta tekanan operasi 5–7 bar dan sudut *nozzle* 45°.

Sampel uji berupa potongan *water wall tube* baja SA210 Grade A diambil dari PLTU Punagaya. Pengujian dilakukan meliputi pengukuran massa, ketebalan, kekerasan (*Vickers*), *microstructure* (mikroskop optik dan SEM-EDX), serta kekasaran permukaan. Hasil pengujian menunjukkan bahwa penggunaan pasir silika menghasilkan laju pengurangan massa dan ketebalan yang lebih besar dibanding *aluminium oxide*, menandakan tingkat abrasi yang lebih tinggi. Sebaliknya, *aluminium oxide* cenderung meningkatkan kekerasan permukaan akibat fenomena *work hardening* dari tumbukan partikel abrasif.

Secara umum, peningkatan durasi *sandblasting* berbanding lurus dengan laju kehilangan massa dan penurunan ketebalan material. Analisis mikrostruktur menunjukkan terjadinya deformasi plastis dan perubahan butiran akibat energi tumbukan partikel abrasif. Hasil penelitian ini memberikan pemahaman mengenai mekanisme abrasi pada CFB boiler serta rekomendasi teknis pemilihan *bed material* yang dapat memperpanjang umur pakai *wall tube* dan meningkatkan keandalan operasi pembangkit.

Kata kunci: CFB boiler, abrasi, wall tube, aluminium oxide, silika, sandblasting, PLN Nusantara Power

ABSTRACT

This research aims to analyze the effect of different types of *bed material* on the abrasion rate (*erosion rate*) in the *wall tube* of a Circulating Fluidized Bed (CFB) *boiler*. The abrasion issue in *wall tubes* is the main cause of leaks and reduced operational efficiency in CFB power plants managed by PT PLN Nusantara Power. Two types of *bed material* tested are *aluminium oxide* (Al_2O_3) and silica (garnet), with variations of *sandblasting* time of 2, 4, 6, 8, and 10 minutes, an operational pressure of 5–7 bar, and a nozzle angle of 45° .

The test samples consist of sections of SA210 *Grade A* steel water *wall tube* taken from the Punagaya power plant. The tests include measurements of mass, thickness, hardness (*Vickers*), microstructure (optical microscope and SEM-EDX), and surface roughness. The test results indicate that the use of silica sand results in a greater rate of mass and thickness reduction compared to *aluminium oxide*, signifying a higher level of abrasion. Conversely, *aluminium oxide* tends to increase surface hardness due to the work hardening phenomenon resulting from the impact of abrasive particles.

In general, an increase in the duration of *sandblasting* is directly proportional to the rate of mass loss and reduction in material thickness. Microstructure analysis shows the occurrence of plastic deformation and grain change due to the energy of impact from abrasive particles. The results of this study provide an understanding of the abrasion mechanism in CFB *boilers*, as well as technical recommendations for the selection of *bed material* that can extend the lifespan of *wall tubes* and improve the operational reliability of the power plant.

Keywords: CFB *boiler*, *abrasion*, *wall tube*, *aluminium oxide*, silica, *sandblasting*, PLN Nusantara Power