ABSTRAK

PENGARUH VARIASI JUMLAH LAYER *COATING* TERHADAP KEKUATAN ADHESI DAN LAJU KOROSI PADA MATERIAL API 5L *GRADE* B PSL 1

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Korosi pada pipa baja karbon API 5L *Grade* B di industri minyak dan gas merupakan isu kritis yang berpotensi menyebabkan kegagalan operasi. Penelitian ini mengevaluasi kinerja sistem pelapisan *epoxy–polyurethane* dengan variasi jumlah lapisan (3, 5, dan 7 *layer*), serta menghadirkan keterbaharuan berupa penentuan konfigurasi lapisan optimal untuk aplikasi pada lingkungan air laut berbasis korelasi langsung antara adhesi, morfologi *coating*, dan laju korosi. Pelapisan dilakukan dengan metode *spraying* dan ketebalan tertinggi diperoleh pada spesimen 7 layer (279,4 µm). Hasil uji adhesi (*tape test X-cut*) menunjukkan peningkatan daya lekat seiring bertambahnya jumlah lapisan, di mana spesimen 7 layer mencapai klasifikasi 5A. Pengujian laju korosi menggunakan *artificial sea water* mengonfirmasi performa terbaik pada sistem 7 layer dengan laju korosi terendah 0,0055 mmpy, jauh lebih rendah dibandingkan 5 layer (0,2380 mmpy), 3 layer (0,5208 mmpy), dan *non-coating* (10,746 mmpy). Analisis SEM–EDX memperlihatkan bahwa penambahan lapisan menghasilkan distribusi *coating* yang lebih homogen serta reduksi signifikan pada area terkorosi. Hasil dari penelitian ini memberikan manfaat praktis bagi industri melalui rekomendasi jumlah lapisan yang paling efektif dan ekonomis untuk meningkatkan umur layanan pipa baja karbon pada lingkungan laut.

Kata kunci: API 5L *Grade* B, *artificial sea water*, *coating*, korosi, *layer*

ABSTRACT

PENGARUH VARIASI JUMLAH LAYER COATING TERHADAP KEKUATAN ADHESI DAN LAJU KOROSI PADA MATERIAL API 5L GRADE B PSL 1

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Corrosion in API 5L Grade B carbon steel pipelines used in the oil and gas industry is a critical issue with the potential to cause operational failure. This study evaluates the performance of an epoxy–polyurethane coating system with different layer configurations (3, 5, and 7 layers) and introduces novelty in determining the optimal coating structure for marine environments based on a direct correlation between adhesion strength, coating morphology, and corrosion rate. The coating was applied using a spraying method, and the highest thickness was obtained in the 7-layer specimen (279.4 µm). Adhesion testing using the X-cut tape method showed improved bonding strength with increasing layer numbers, where the 7-layer configuration achieved a 5A classification. Corrosion testing in artificial sea water confirmed the superior performance of the 7-layer system, which demonstrated the lowest corrosion rate at 0.0055 mmpy, significantly lower than the 5-layer (0.2380 mmpy), 3-layer (0.5208 mmpy), and non-coated (10.746 mmpy) samples. SEM–EDX analysis further confirmed that increasing coating thickness resulted in a more homogeneous surface morphology and a substantial reduction in corrosion-affected regions. The findings of this research provide practical value to industry application by offering recommendations on the most effective and cost-efficient coating configuration to enhance the service life of carbon steel pipelines in marine environments.

Keywords: API 5L Grade B, artificial sea water, coating, corrosion, layer