

ABSTRAK

PENGARUH KETEBALAN *POLYURETHANE COATING* TERHADAP KETAHANAN KOROSI DAN KEKUATAN ADHESI PADA BAJA API 5L GRADE B

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Penelitian ini bertujuan menentukan pengaruh variasi ketebalan *polyurethane coating* (50 μm , 100 μm , 150 μm) terhadap ketahanan korosi dan kekuatan adhesi pada pelat baja API 5L Grade B melalui pendekatan eksperimen. Variabel ketebalan diaplikasikan dengan metode *spray*, kemudian diuji ketahanan korosinya menggunakan polarisasi potensiodinamik pada media NaCl 3,5% untuk memperoleh parameter E_{corr} , I_{corr} , dan laju korosi, sedangkan evaluasi adhesi dilakukan menggunakan *X-Cut Adhesion Test* sesuai standar ASTM D3359. Hasil uji menunjukkan peningkatan ketebalan *coating* membuat laju korosi menurun dari 0,093 mmpy (50 μm) menjadi 0,079 mmpy (100 μm) dan terendah 0,024 mmpy (150 μm), disertai pergeseran E_{corr} ke arah lebih mulia serta penurunan I_{corr} . Kekuatan adhesi menunjukkan bahwa seluruh variasi ketebalan *polyurethane coating* 50 μm , 100 μm , dan 150 μm memperoleh nilai adhesi yang sama yaitu 4A. Hasil ini menunjukkan terjadinya pelupasan pada area sayatan, sehingga adhesi *coating* terhadap substrat tetap berada pada kondisi baik. Pengujian foto makro menunjukkan bahwa ketebalan lapisan *polyurethane* mempengaruhi kualitas permukaan *coating*. Pada ketebalan 50 μm masih terlihat cacat mikro akibat kemampuan perataan lapisan yang terbatas sebelum proses curing. Sedangkan, pada ketebalan 100 μm dan 150 μm permukaan *coating* tampak lebih homogen dan merata karena waktu alir lapisan yang lebih optimal. Hasil ini memperlihatkan belum terdapat retak pada seluruh variasi ketebalan, namun ditemukan cacat permukaan berupa *waviness* dan *pin-hole* kecil yang secara teori dapat menjadi titik awal retak bila terjadi beban termal/mechanik atau paparan korosif berulang. Dengan demikian, ketebalan 150 μm memberikan performa paling baik dalam meningkatkan perlindungan korosi sekaligus mempertahankan daya lekat *polyurethane coating* pada baja API 5L Grade B.

Kata kunci: API 5L Grade B, laju korosi, polarisasi potensiodinamik, *polyurethane Coating*, *x-cut tape test*.

ABSTRACT

THE EFFECT OF POLYURETHANE COATING THICKNESS ON CORROSION RESISTANCE AND ADHESION STRENGTH OF API 5L GRADE B STEEL

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This study aims to determine the effect of variations in polyurethane coating thickness (50 μm , 100 μm , 150 μm) on corrosion resistance and adhesion strength of API 5L Grade B steel plates through an experimental approach. The thickness variable was applied using the spray method, then its corrosion resistance was tested using potentiodynamic polarization in 3.5% NaCl media to obtain the E_{corr} , I_{corr} , and corrosion rate parameters, while adhesion evaluation was carried out using the X-Cut Adhesion Test according to ASTM D3359 standards. The test results showed that increasing coating thickness decreased the corrosion rate from 0.093 mmpy (50 μm) to 0.079 mmpy (100 μm) and the lowest was 0.024 mmpy (150 μm), accompanied by a shift in E_{corr} towards a nobler direction and a decrease in I_{corr} . The adhesion strength shows that all variations of polyurethane coating thickness of 50 μm , 100 μm , and 150 μm obtained the same adhesion value of 4A. This result indicates that peeling occurred in the incision area, so that the coating adhesion to the substrate is in good condition. Macro photo testing shows that the thickness of the polyurethane layer affects the quality of the coating surface. At a thickness of 50 μm , micro defects are still visible due to the limited ability of the coating to level before the curing process. Meanwhile, at a thickness of 100 μm and 150 μm , the coating surface appears more homogeneous and even due to a more optimal coating flow time. This result shows that there are no cracks in all thickness variations, but surface defects are found in the form of waviness and small pin-holes which in theory can be the starting point of cracks if there is a thermal/mechanical load or repeated corrosive exposure. Thus, a thickness of 150 μm provides the best performance in increasing corrosion protection while maintaining the adhesion of the polyurethane coating to API 5L Grade B steel.

Keywords: API 5L Grade B, corrosion rate, potentiodynamic polarization, polyurethane coating, x-cut tape test.