INTISARI

Teknik pengelasan busur terendam atau *submerged arc welding* (SAW) banyak digunakan dalam pembuatan pipa minyak dan gas. Secara umum, sambungan las busur terdiri atas logam las, daerah terpengaruh panas atau *heat affected zone* (HAZ) dan logam induk. Penelitian ini bertujuan untuk mempelajari perilaku struktur mikro, kekerasan, ketangguhan impak, kekuatan tarik dan laju korosi sambungan las SAW beserta pengendaliannya melalui penambahan inhibitor organik.

Pada penelitian ini, pipa spiral dari baja API 5L X-52 dilas dengan las SAW. Parameter las yaitu arus (I), tegangan (E) dan kecepatan las masing-masing sebesar 825 Amper, 35 Volt dan 7,5 mm/s. Pengujian korosi dilakukan dalam larutan 0,1 M $NaHCO_3$ dengan penambahan inhibitor *imidazoline* dan *ethoxylated fatty amine* (EFA) dengan variasi konsentrasi dari 0 sampai 100 ppm. Metode pengujian korosi yang dipakai berupa teknik polarisasi elektrokimia Tafel dan *electrochemical impedance spectroscopy* (EIS).

Hasil penelitian menunjukkan bahwa struktur mikro logam las terdiri dari ferit asikular dan ferit batas butir, daerah HAZ terdiri atas struktur bainit, ferit dan perlit, sedangkan pada logam induk terdiri dari ferit dan perlit. Logam las memiliki nilai kekerasan paling tinggi, kemudian menurun pada bagian HAZ hingga hingga mencapai nilai konstan pada logam induk. Kekuatan tarik logam las lebih tinggi dibandingkan dengan logam induk karena terbentuknya struktur mikro ferit asikular namun logam las memiliki nilai impak paling rendah dibanding bagian HAZ dan logam induk. Bagian HAZ memiliki laju korosi paling tinggi dibandingkan logam las dan logam induk. Penambahan inhibitor *imidazoline* dan EFA memberikan penurunan laju korosi dari daerah HAZ. Inhibitor *imidazoline* memiliki efisiensi lebih tinggi dibandingkan inhibitor EFA.

Kata Kunci : API 5L X-52, pengelasan, sifat mekanis, korosi, inhibitor korosi

ABSTRACT

Submerged Arc Welding (SAW) is widely used in the manufacture of oil and gas pipelines. In general, a weld joint consists of various regions including weld metal, heat affected zone (HAZ) and base metal. This research is aimed to study microstructure, hardness, impact toughness, tensile strength and corrosion rate of submerged arc welded joints with its control using organic inhibitors.

In this research, API 5L X-52 steel pipe was welded spirally using SAW technique. Welding parameters used including welding current (I), arc voltage (E) and welding speed were 825 Ampere and 35 Volt and 7,5 mm/s respectively. Corrosion testing was carried out in 0,1 M $NaHCO_3$ solution with the addition of imidazoline and ethoxylated fatty amine (EFA) corrosion inhibitors. The methods used included Tafel electrochemical polarization and *electrochemical impedance spectroscopy* (EIS).

The results show that microstructure of the weld metal consists of acicular ferrite and grain boundary ferrite. On the other hand, the HAZ region is composed of a mixture of bainite, ferrite and pearlite structures, whilst the base metal consists of ferrite and pearlite. The weld metal has the highest value of hardness, then the hardness continuously decreases in the HAZ until it achieves a constant value in the base metal. The tensile strength of the weld metal is higher than that of the base metal due to its fine grained acicular ferrite but its impact toughness is lower compared to that of HAZ and base metal. HAZ region has highest corrosion rate compared to weld metal and base metal. The additions of both imidazoline and EFA corrosion inhibitor provided a decrease in the corrosion rate of HAZ. However, in comparison with EFA inhibitor, imidazoline seems to have better inhibition efficiency.

Keywords : API 5L X-52, welding, mechanical properties, corrosion, corrosion inhibitor