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A Client

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Your Ref:
Our Ref:00701501

Dear Sir

Assessment of Stress Corrosion Cracking in Bioethanol and the Benefits of SBZ1895

Further to our previous discussions regarding the above, and the conclusions of the API report 939-D, we have carried out a couple of cyclic potentiodynamic polarisation scans (PD Scans) in commercial bioethanol product from tank 64 against type 1018 carbon steel.

We carried out the PD scans at ambient temperature, at a scan rate of 100mV per minute. Unlike conventional PD scans, we did not want to introduce water into the test solution, so we used a pair of platinum electrodes back to back as a bridge into a potassium chloride solution, where the saturated calomel electrode was located. In this way, we avoided seepage from the reference electrode into the test liquor.

We carried out an initial test which we then repeated under identical conditions, to check for reproducibility. We were pleased to find excellent correlation between the two curves and between the rest potentials (also known as free corrosion potentials) of $-0.1138V_{SCE}$ and $-0.0952V_{SCE}$.

As a third test, we added 1% water and 0.2g (about 0.1%) of potassium chloride to the test solution and repeated the scan. The result was surprisingly different to the previous two. The rest potential was $-0.1264V_{SCE}$ and the current densities were significantly higher than for the "as-received" bioethanol. The repassivation potential was also much lower for the "wet" bioethanol than for the "as-received", having a value of $-0.036V_{SCE}$ against $+0.857V_{SCE}$.

The fourth test we carried out was a potentiostatic test again on "wet" bioethanol, but then the SBZ1895 added at a concentration of 1%. The rest potential was seen to rise by about 100mV from the rest value within an hour, and by a further 100mV in the following 24 hours.

This shift in potential was sufficient to move the rest value out of the stress corrosion cracking (SCC) band and thereby significantly reduce the risk of such a phenomenon occurring in a carbon steel tank containing bioethanol treated with this denaturant.

Conclusions

It would appear from this testing that the presence of water, chlorides and probably oxygen can cause a shift in rest potentials of carbon steel in bioethanol to the point where stress corrosion cracking is a significant risk. However, the addition of 1% SBZ1895a causes a reversal of this potential shift and maintains the rest potential in a "safe" region of the polarisation curve.

Yours sincerely

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