

## USE OF E-NICKEL TO INCREASE SERVICE LIFE OF FILTER HOUSINGS, FILTER ELEMENTS AND PIPING IN SOUR GAS SERVICE

The oil and gas industry can often demand corrosion resistance to chemical compounds that attack most of the commonly used alloys. It has been our experience that the use of electroless nickel plating on pressure vessels and other wetted components in sour or acid service provides the most economical solution to many commonly found conditions.

The compounds that we have found to corrode are a combination of water with carbon dioxide, hydrogen sulfide and various chlorides (brines, seawater, and reef water). Any of these combinations form acids in a wide variety of combinations and % concentrations. The selection of metal components used in the field has traditionally been carbon steel, 300 series stainless steel, nickel 200, lined pipe and other more exotic alloys.

Carbon steel corrodes faster than 300 series stainless under most conditions but the cost is significantly lower. If chlorides are present 300 series stainless is subject to early failure due to stress corrosion cracking which significantly shortens the service life.

Even highly passivated stainless steel will continue to corrode in the presence of hydrogen sulfide in a low or no oxygen environment. Without oxygen no protective layer ever forms to resist further corrosion.

The use of electroless nickel has many specific examples in the oil and gas industry. The use on ball and plug valves has shown to extend service life from three months to more than 2 years in a 55% hydrogen sulfide environment<sup>1</sup>.

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<sup>1</sup> Parkinson, Ron, "Properties and Applications of Electroless Nickel", [Nickel Development Institute](#), 1997

Electroless nickel has been shown to have superior performance on valves, chokes and other components in highly corrosive Khuff gas wells. The specifics are numerous with references found at the end of this article.

Our finding is that the use of a high phosphorous grade of electroless nickel provides a high rate of corrosion resistance compared to both carbon steel and 300 series stainless steel. The cost of a treated vessel is between the cost of carbon steel and 304 stainless.

Electroless nickel comes in many forms. The form that proves to be the most corrosion resistant is 90% nickel and 10+% phosphorous<sup>2</sup>. Electroless nickel forms a very uniform deposit on all interior surfaces as opposed to electrodeposited nickel.

The process of applying electroless nickel does not impact the strength of the base metal and will not impact the integrity of hydro-tested and ASME approved vessels. The thickness of an electroless nickel deposit is normally between .8 and 3 mils, which often will require that threaded connections or components with tight fit tolerances be masked during deposition. Resistance to corrosion increases with increasing deposit thickness<sup>3</sup>.

In general we have found that in non-erosive service the electroless nickel plated product is superior to 300 series stainless. The advantage is twofold, longer service life and less corrosion, which is the object of filtration efforts.

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<sup>2</sup> ASTM B 733, "Standard Specification for Autocatalytic Nickel-Phosphorus Coatings of Metal, 2004

<sup>3</sup> Watson, Dr. S. Alec, "Electroless Nickel Coatings" DiDL Technical Series No. 10055, [Nickel Development Institute](#), 1990