

OILFIELD CORROSION

- Challenges of dealing with dissolved Oxygen and overcoming its effects
- Effects of high TDS / Chloride and how to minimize its corrosiveness
- pH, Temperature, flow-rate, pressure (dissolved CO₂ and H₂S), and abrasion effects will be magnified

APPLICATIONS SUSCEPTIBLE TO OXYGEN AND HIGH TDS / CHLORIDE CORROSION

Frac / Stimulation – can be both if recycled water used

Coiled Tubing / Drill out fluids – as above

Drilling fluids

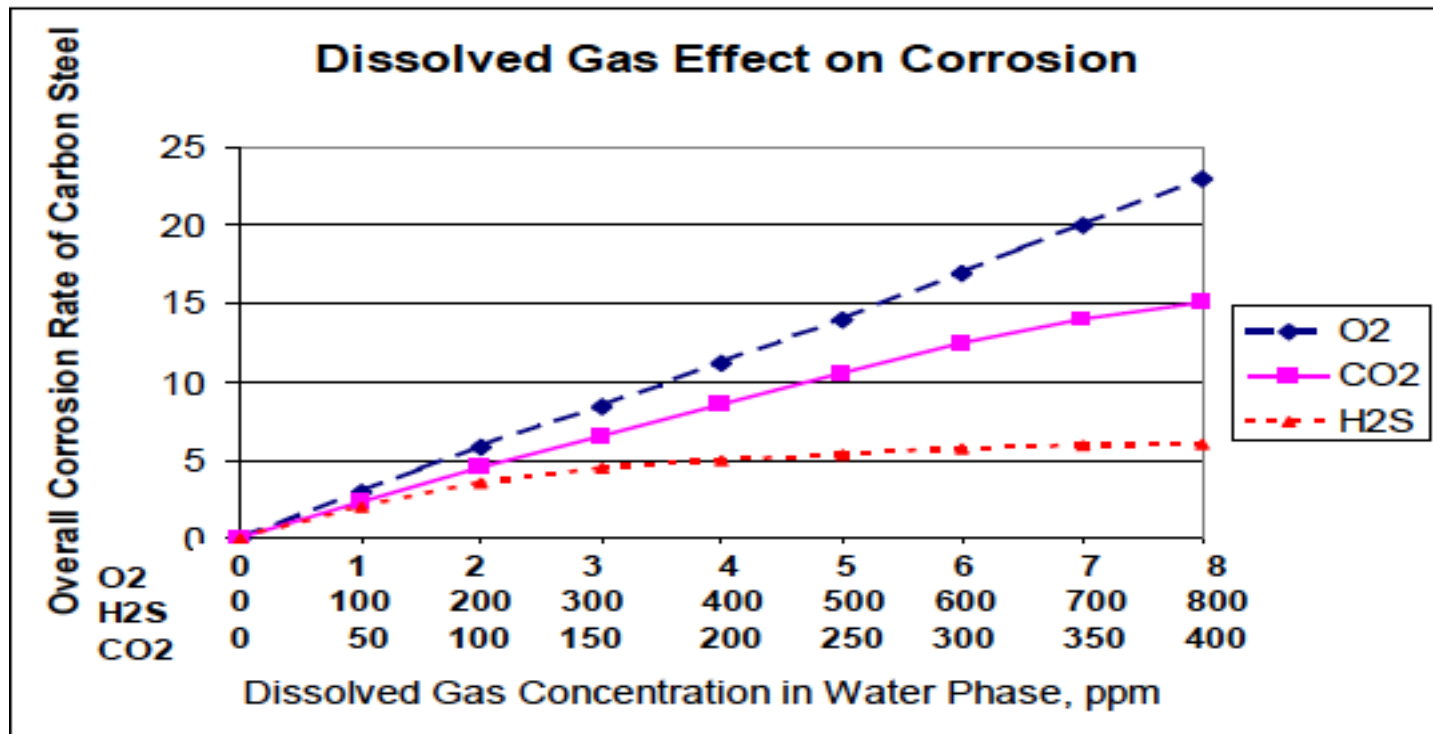
Production Tubulars

Gas transfer pipelines

Produced water storage tanks

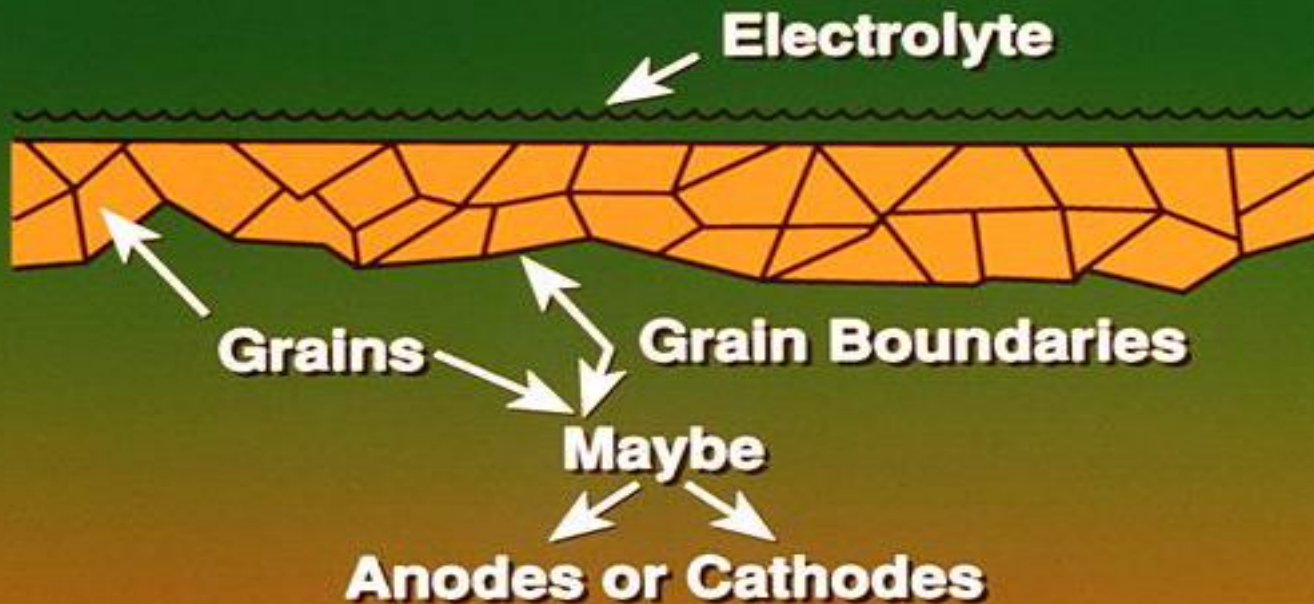
OXYGEN CORROSION

..... There is no corrosion mechanism more damaging on a concentration basis than oxygen – small amounts of oxygen, water and chlorides can ruin even a chrome tubing completion in a few months.



HIGH TDS / CHLORIDE CORROSION

Anodes can form on a single piece of metal that has small crystals of slightly different composition.



INHIBITOR REQUIREMENTS FOR OXYGEN & HIGH TDS CORROSION CONTROL

- Traditional Imidazoline / Quat type chemistry is typically not effective or economical due to presence of Oxygen. Use of Oxygen scavengers is not advisable due to water volumes & Sulphate ion addition
- Need to be compatible with other fluid chemical additives and brine constituents
- Effectiveness at low dose levels due to large water volumes
- Preferable aqueous phase activity – i.e. non partitioning

CORROSION TESTS – FRAC WATER

1) Fresh pond water with typical dose rates of two different Phosphonate based Scale inhibitors after 3 weeks at room temperature.



CORROSION TESTS – FRAC WATER

2) Mild steel coupons submersed in 120,000 ppm TDS brine containing various Inhibitors. Left two coupons were after 1 week. Middle coupon (corrosion rate of ~ 0.5 mpy) was after 365 days. Right two coupons were after 180 days



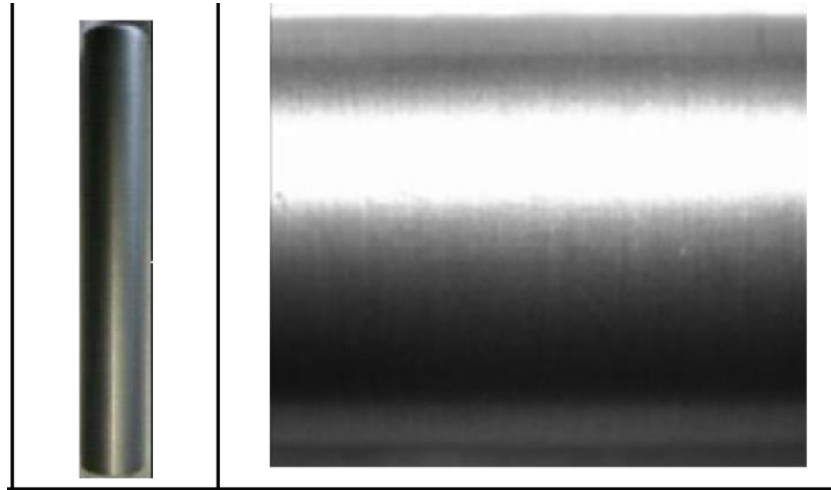
CORROSION TESTS – COILED TUBING DRILL-OUT WATER

3) Coil pieces without and with inhibitor after 48 hours recirculation in 2% KCl brine. Temperature range from 70 – 90° F. Metal loss was reduced by > 95% with inhibitor



CORROSION TESTS – AQUEOUS DRILLING MUD

4) Test run for 96 hours in 25% primarily NaCl brine at 90° C and pH of 10 achieved a Corrosion rate of 0.43 mpy. Despite use of traditional amine inhibitor were still experiencing in loss of “6 – 8 Lbs of metal per foot per year”.



Summary & Conclusions

- The widespread use of hydraulic fracturing and reuse / recycling of produced fluids has significantly expanded the susceptibility of oilfield applications to Oxygen and high TDS corrosion
- Corrosion Inhibitor chemistry is advancing in performance under these conditions, and is capable of delivering strong results to minimizing metal loss
- Adequately addressing the effect of corrosion during drilling, frac, and drill-outs will improve the performance / reduce the “strain” on production chemical treatments
- Similar approaches to treating frac, drilling, and drill-out fluids can be applied to controlling corrosion in pipelines and storage tanks