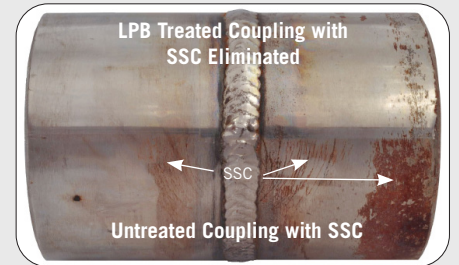
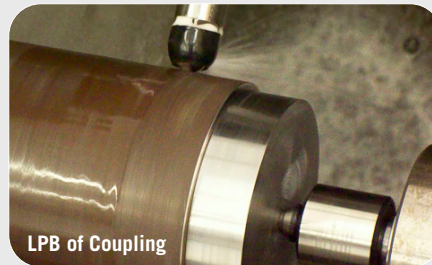
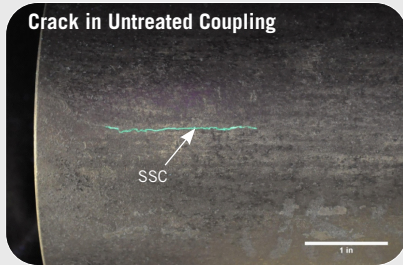
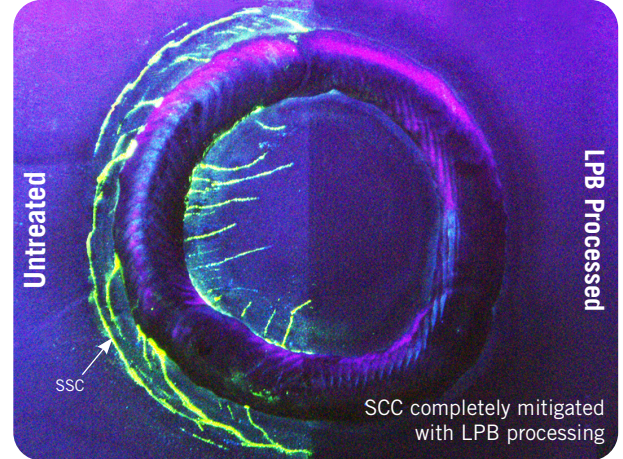




## Eliminating SCC and SSC in Sour Environments

The United States alone produces 8.5 million barrels of oil and natural gas per day, relying on heavy pipes and couplings for drilling and recovery efforts. Corrosive compounds like H<sub>2</sub>S and NaCl are commonly encountered downhole, creating a “sour” environment that, combined with high stresses, can cause stress corrosion cracking (SCC) and corrosion fatigue failures in drill pipe and casings. High strength steels used in these applications are subject to sulfide stress cracking (SSC) and hydrogen embrittlement (HE). Couplings are particularly vulnerable to these failure mechanisms due to the high stresses imposed in directional drilling. Stress concentrations are generated by connection interfaces during power make-up and exacerbated when subjected to service loads, creating the perfect environment for crack initiation. As more deep wells and offshore resources are developed, a cost-effective method of mitigating failure from SSC and corrosion fatigue is required to reduce operational costs and potential environmental damage.



**SOLUTION:** By introducing a deep, stable layer of compressive residual stress, Lambda’s low plasticity burnishing (LPB®) technology has been shown to eliminate SSC and SCC in high strength steels. LPB offers unprecedented control of residual stresses, providing superior protection for a fraction of the cost of SCC resistant alloys.

A study was initiated to evaluate the effects of LPB on corrosion fatigue and SSC on quench and tempered API P110 steel. LPB processed specimens had an increase in fatigue life greater than an order of magnitude over untreated specimens. The LPB process was successful in completely mitigating SSC in all test specimens, providing an economical means of SSC mitigation and fatigue strength improvement.

**IMPACT:** Thousands of couplings have now been LPB processed and put into service. Significant cost savings are anticipated for the fossil fuel industry by completely preventing sour well failures of these couplings. In addition to eliminating the need for expensive SCC resistant alloys, LPB allows the use of higher strength ferritic steels and higher stress levels in directional drilling. Failure prevention with LPB contributes to both environmental safety and improved production opportunities, while reducing operational costs and risk.

### AP110 Steel Coupling Pressure Test NACE A Solution, 25° C

