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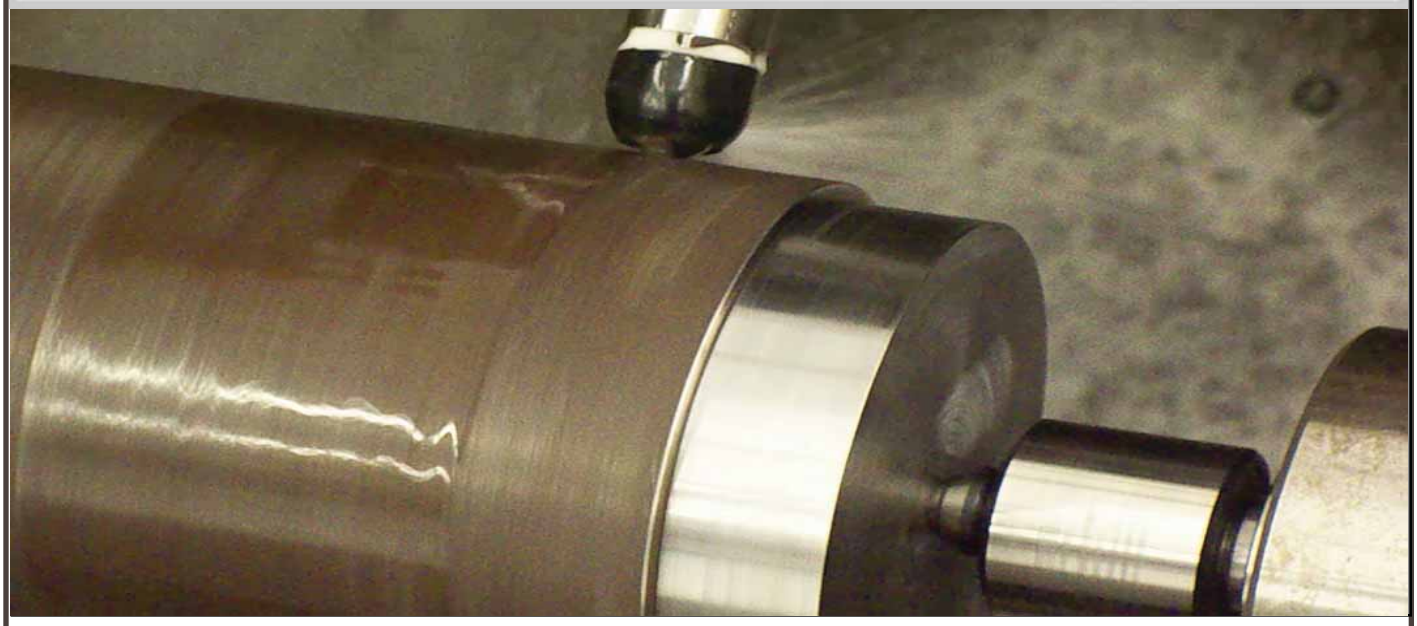
LPB® Application Note

IMPROVING COMPONENT LIFE AND PERFORMANCE

OIL COUNTRY TUBULARS



LPB Eliminates SSC in Steel Couplings

'Sour' environments in oil and gas recovery operations can severely limit the types of materials available for down-hole applications. Sulfide Stress Cracking (SSC), Stress Corrosion Cracking (SCC) and Hydrogen Embrittlement (HE) can prevent the use of common high strength steel alloys. The current method to mitigate cracking is to use more expensive alloys with increased corrosion resistance. Low plasticity burnishing (LPB) provides a different approach. By introducing a deep, stable layer of compressive residual stress, LPB has been shown to eliminate SSC in high strength steels, providing a cost-effective solution to the problem.

- Mitigates Sulfide Stress Cracking
- Does Not Alter Material or Design
- No Need for Heat Treating
- Allows Use of Less Expensive Material

As more deep wells and offshore resources are developed, it is important to find new ways to mitigate corrosion related cracking. LPB offers unprecedented control of residual stresses providing superior protection for a fraction of the cost of new alloys.

Lambda Technologies ■ 3929 Virginia Avenue, Cincinnati, OH 45227
Tel (513) 561-0883 ■ Toll Free/U.S. (800) 883-0851 ■ Fax (513) 322-7186

www.lambdatechs.com

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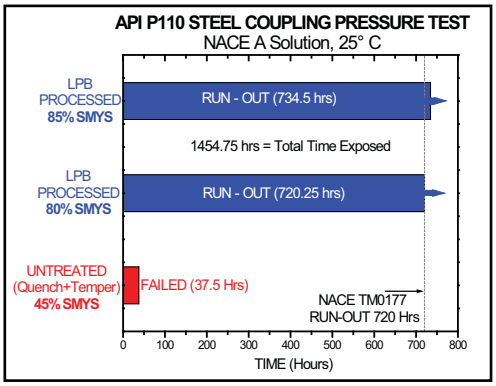
Mitigating SSC in Steel

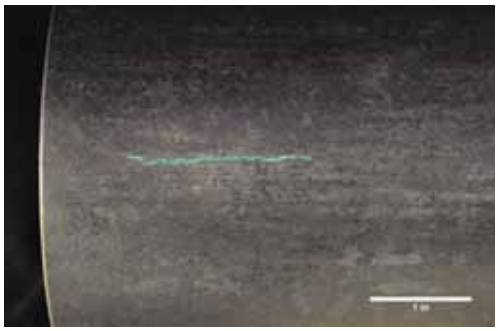
SSC Testing was conducted on API P110 quench and temper coupling stock. Specimens were tested in both the untreated condition and after LPB processing to determine the differential effects resulting from LPB treatment. All tests were performed in a saturated hydrogen sulfide solution. The couplings were internally pressurized hydraulically to impart applied hoop stress. Testing was conducted until specimen failure or a run out life of 720 hours or more was achieved. All testing comformed to NACE standards.

The untreated coupling blank failed at 45% specified minimum yield strength (SMYS) after the entire OD surface was exposed for 37.5 hours. The LPB processed specimens exceeded 720 hours at 45%, 80% and 85% (SMYS) stress levels, surpassing typical hold-time requirements for sour service testing and exceeding API standards for stress levels in corrosion resistant materials. The second full sized LPB coupling blank ran for a total of 1454.75 hours before testing was terminated.

Dye penetrant inspection used on the LPB treated coupling after timed run out showed no cracks of any size initiating on the specimen. The 85% SMYS stress level is regarded as an aggressive performance test for metal that is in direct contact with a 100% saturated environment.

The results show that LPB is able to mitigate SSC and dramatically increase the life of common API P110 steel. LPB completely eliminated SSC failure in all tested specimens.





LPB is a highly effective, reliable and reproducible method of imparting deep compressive residual stresses to protect components from SSC. The process uses a closed-loop feedback surface enhancement method capable of introducing a customized compressive residual stress field specifically tailored for each application. The CNC controlled tooling can be easily integrated with existing equipment used for manufacture and repair of down-hole tubular products. LPB can provide the needed improvement in damage tolerance to ensure safe, cost-effective operation in sour environments.

To learn how LPB can save you money on tubular goods, please visit www.LambdaTechs.com or contact Kim Bellamy at (513)561-0883.

References:

- J. Scheel, N. Jayaraman, D. Hornbach, D. Chelette, P. Moore. "Mitigation of Sulfide Stress Cracking in Down Hole P110 Components via Low Plasticity Burnishing." March 2011, http://www.lambdatechs.com/publications/280.pdf.
- J. Scheel, N. Jayaraman, D. Hornbach. "Preventing Stress Corrosion Cracking of Nuclear Weldments Via Low Plasticity Burnishing." April 2010, http://www.lambdatechs.com/html/resources/278.pdf.

http://www.lambdatechs.com/publications/publications.html

Accreditation:

- ISO/IEC 17025 Accredited Laboratory
- ISO 9001:2008 Certified

For more information on Lambda, LPB or to read complete papers, please visit www.LambdaTechs.com

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