



Evaluation of Hydrogen Cracking in Weld Metal Deposited by Cellulosic Coated Electrodes DTRS56-04-T-0010

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OPS ACCOMPLISHMENTS

Challenge

Pipeline Safety
Research and
Development for
Focus area:

Improved
Materials
Performance

Cellulosic-coated electrodes (primarily AWS EXX10-type) are traditionally used for “stovepipe” welding of pipelines because they are well suited for deposition of pipeline girth welds and are capable of high deposition rates when welding downhill. Extensive work was undertaken in the 1970s and 1980s to study heat affected zone (HAZ) hydrogen-assisted cracking, and guidelines were developed to avoid HAZ hydrogen cracking by controlling heat input and preheat. Improvements in steel making practice and the trend towards leaner chemistries have also helped to alleviate HAZ hydrogen cracking. In recent years, weld metal hydrogen cracking has become more of an issue with the trend towards higher-strength steels and welding with minimal or no preheat.



Despite advances in mechanized welding technology, manual welding using cellulosic coated electrodes is widely utilized throughout the world

Technology Description

- 1) Determine the effect of electrode drying and arc length on weld metal properties and hydrogen cracking susceptibility
- 2) Determine the effect of electrode re-hydration on weld metal properties and susceptibility, and
- 3) Develop practical guidelines on how to prevent hydrogen cracking in weld metal deposits using cellulosic covered electrodes

Accomplishments

- ◆ Sixteen types of welding electrodes from 3 different suppliers have been selected and procured for testing.
- ◆ Preliminary welding and testing of dried electrodes was conducted.
- ◆ Re-hydration studies are underway. Coating moisture and weld metal chemical analyses were performed on each of the re-hydrated electrodes.

Contact

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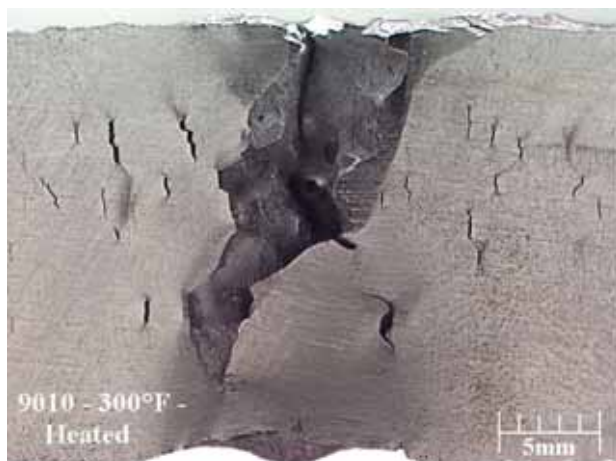
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Weld metal bend test specimen produced with improperly conditioned cellulosic welding electrode. These results graphically illustrate the importance of the development of best practice guidelines.

Benefits

This research will advance pipeline safety by providing a definition of conditions that can lead to hydrogen cracking in cellulosic shielded metal arc welded joints in pipelines and the development of welding guidelines to prevent weld metal hydrogen cracking.

Future Activities

- ◆ Analyze completed test results for the dried and re-hydrated electrode studies
- ◆ Select electrodes for further testing
- ◆ Optimize re-hydration conditions

Partners in Success

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