IBAT Meeting

September 21, 2017

Participating Agencies: BSEE, NIST, NASA, Navy, DOE-NETL

ASTM Week – Hydrogen Embrittlement (HE) Forum worth considering attending (November, 2017, Atlanta, GA)

Torq-Comm Presentation: Overview on quality control for torqueing of bolts. Explained new technology for monitoring applied torque and ensuring it meets the torqueing plan.

ASTM B633 Telecom Concerns

- Navy will engage with ASTM B633 & ASTM F1941 to work with them on developing bolt coating requirements
    - Committees are working together to harmonize bolting requirements
    - Expects to have some difficulty
- DOE NETL will give presentation at the ASTM Week on Corrosion performance of ultra-high strength steels in Brines
    - UD 165
    - Presentation slides will be shared with IBAT

Recommended Bolt Manufacturer Test Requirements & Hydrogen Embrittlement

- NIST – recommend bolt manufacturers to test bolts for strength rather than hardness, HE.
    - Presented hardness as a red herring for strength in high strength steels
    - Recommended to test for hydrogen susceptibility
    - Should test individual batches of bolts
    - Hardness does not give true indication of bolt material properties
    - No correlation between hardness and strength in the higher strength steels
        - Navy agrees with this statement.
    - Testing of hydrogen embrittlement has been done under ideal conditions and may not translate to real life situations
    - The data currently available is not enough to correlate hardness and hydrogen susceptibility

Hydrogen Embrittlement Analysis & Recommended Materials for Subsea Applications

- NASA
    - Currently there are no standards specifying acceptable hydrogen susceptibility limits
    - Establish limits for each material through testing
    - Recommends analyzing for hydrogen embrittlement
    - Assess the environment to determine how much hydrogen the material will be exposed to and design for that.
    - There is nowhere near enough data to rely on hardness as a method, or select 35 as the magic number.
    - Superalloys are not always the best answer – even high strength super alloys have issues with hydrogen. Bottom line, don't pick the wrong material for the environment.
- Navy
    - Navy has moved away from iron based materials (for subsea applications)
    - Use more nickel, copper, etc for underwater environments.

    - Typically lean towards monel, k-monel for seawater applications due to corrosion resistance
- NIST – how do you know what's good and bad

Irish coast bolt failure

- Careful comparing the Irish coast bolt failure to US bolt bolt failures
- It may not have any correlation due to the difference in manufacturing and material standards (ISO vs US)