



EXPERIENCE & REFERENCES

CONTACT



Norbert Trimborn

- Studies of Applied Physics and NDT
- Certified in Ultrasonic:
 - Testing level 3 EN473, ASNT UTLIII, TOFD LIII, PA LIII
- Specialist advanced NDT:
 - Time of Flight Diffraction (ToFD), Phased Array (PA), Ultrasonic Testing (UT), Guided Wave (GW), Hot Hydrogen Attack (HTHA), HIC, Pipe Support Inspection
- Experience in detection and quantifying of HTHA over the past 25 years

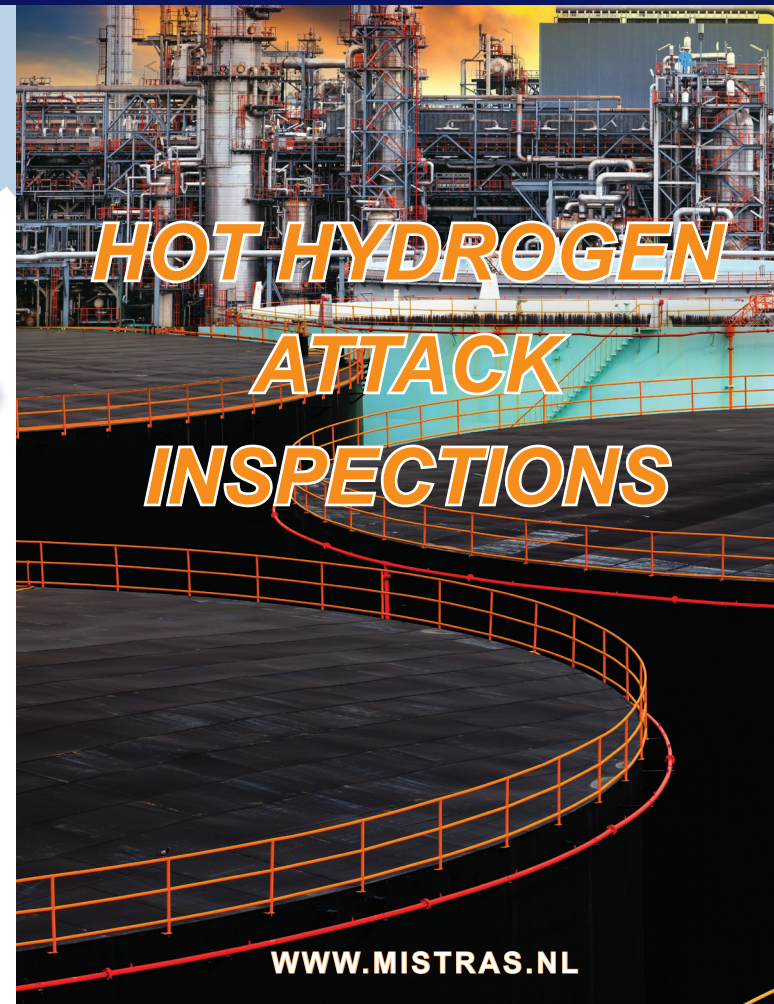


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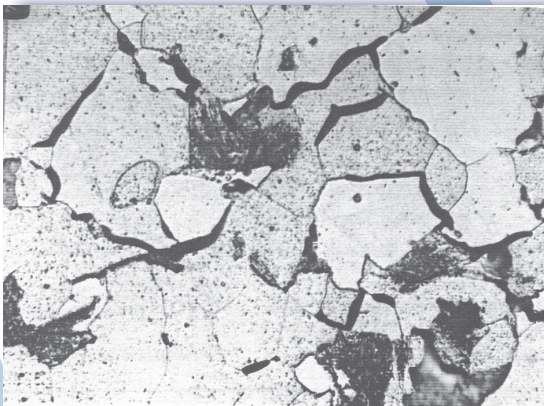
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HOT HYDROGEN ATTACK (HTHA)

The presence of Hydrogen in industrial plants is a source of damage. HTHA is one such form of degradation which is due to the formation of Methane (CH₄) by reaction with carbon in steel. HTHA can occur either in the parent material or in the weld itself and manifests itself in several types of alloys.

The probability of HTHA damage in plant is dependent on the partial hydrogen pressure, operating temperature, and alloy. Methane formed by the reaction accumulates at internal voids on the grain boundaries, where under certain conditions the build-up can produce micro-cracks. In the weld material this leads mostly to a leak before break situation but when the damage is in the parent material, the result is mostly catastrophic for people and the environment.



ABSOLUTE DETECTION & MONITORING

The inspection methodology developed by Mistras gives an absolute indication of the presence of HTHA in parent material, as long it is above the (low and safe) detection threshold. Decisions can be made immediately, there is no risk of an ambiguous result. If necessary in order to measure the progress of attack, the inspection methodology generates data that can be monitored very accurately, on-line, and at temperatures of up to 450 degree Celsius.

The inspection methodology uses advanced techniques including Time Of Flight Diffraction (TOFD), ultrasonic Backscatter, and velocity ratio measurements. This inspection methodology meets the HTHA inspection approach proposed in API 941.

Backscatter Technique

- Fast screening technique for large areas that gives an indication of the presence of HTHA
- Note: Will not detect HTHA if 100% of the wall thickness is attacked

Velocity Ratio Technique

- Discriminates between indications resulting from inclusions from manufacturing, and indications due to HTHA micro-cracks filled with CH₄ (Methane)
- Discriminates, between 0% and 100% attack
- Measures extent of attack, between 0% and 100% of wall thickness
- Point measurements are carried out

ADVANTAGES & CONCLUSIONS

Advantages:

- Significant reduction of risk results from using the Mistras inspection methodology
- Actions can be taken immediately, as the origin of indications are classified with extremely high reliability
- Attack can be detected at an early stage when the asset has a long remaining lifetime
- The progress of attack can be monitored accurately
- Examination is non-intrusive, resulting in major cost savings
- The inspection methodology is based on more than 25 years of traceable experience. To date no incorrect assessments have been made

Conclusions:

- The Mistras inspection approach is based on more than 25 years of experience
- The Mistras inspection approach has been proven to be reliable and reproducible
- Clear unambiguous presentation of results
- All geometries can be inspected
- Inspection conforms with procedures, using trained and certified Operators