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Electromagnetic Acoustic Transducers (EMAT)

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ELECTROMAGNETIC ACOUSTIC TRANSDUCERS (EMAT)

THE NEED

The current accepted non-destructive evaluation methods used in the inspection of welds have several shortcomings regarding cost, false defect indications, and lack of sensitiveness to certain flaw orientations in welds. Electromagnetic Acoustic Transducers (EMAT) technology combines ultrasonic techniques with modifications to correct these shortcomings and add a flaw discriminator that provides a reject alarm on flaws with a through-wall depths of 10% or greater, but passes passes with a through-wall depth of 5% or less. This meets code requirements for flaw detection, and produces considerable savings in material by rejecting only material with serious flaws.

THE TECHNOLOGY

The EMAT technology combines the advantages of ultrasonic testing (UT) providing the generation of ultrasonic waves including surface waves, longitudinal waves that operate at elevated temperatures and allows rapid scanning. In addition, the operating characteristics of EMATs can be reproduced from one unit to another very easily making them potentially useful as ultrasonic standards. This technology has gone a long way and previous shortcomings like the limitation on cable length between the EMAT and electronic system. EMAT applications include:

- Volumetric Inspection of Welds
- Inspection of External Fuel Tank Welds
- Circumferential Weld Inspection
- Submarine Weld Inspection
- Inspection of Seam Welded (ERW) Tubing
- Offshore Tension Leg Weld Inspection System.

THE BENEFITS

Magnetic particle testing (MT) is recognized as the NDE method of choice for surface inspection of welds in ferromagnetic material, but it can be difficult to apply, unreliable, not repeatable, and subject to false defect indications (magnetic ghosts). In addition, MT can be costly in terms of the time required to perform an inspection, and increasing

environmental regulations require proper use and disposal of the magnetic particles. Radiography (RT) is the typical volumetric test method, but is insensitive to certain flaw orientations and can be quite costly in terms of labor and licensing requirements. Welds can crack as a result of variables in the welding process, and porosity, lack of fusion/penetration are always a concern. EMATs have been evaluated as a replacement for MT for surface inspection and for radiography (RT) for volumetric inspection of welds in the shipyard in a program sponsored by the SP-7 welding panel of the National Shipbuilding Research Program. The high temperature capabilities of EMATs can be especially useful in cases where it is desirable to inspect a weld immediately after or even during the welding process when the weld and base metal are still hot. A patented technique based on diffraction can be used to perform a simultaneous surface and volumetric inspection of the weld with a single linear scan (no raster motion required) along the weld axis. A collinear pitch-catch sensor arrangement eliminates the root/crown signals, but is sensitive to all flaw orientations, providing easy interpretation of inspection data. The latest SIR systems allow engineers to survey structures with expediency and be able to assess the structural state of a structure in a matter of hours.

STATUS

EMAT technology is currently being used by J. Ray McDermott in conjunction with Shaw Pipeline Services in different applications regarding non-destructive evaluation of pipeline welds, offshore tension leg weld inspection, and other applications in the field of inspection of welds and materials.

BARRIERS

The equipment required to perform NDE through EMAT technology is very hard to obtain. Most EMAT systems are the result of modifications to commercially available electronic equipment. Magnetic Particle testing and radiography are accepted techniques in the industry and it will take time for the industry to shift to the EMAT technology.

POINTS OF CONTACT

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REFERENCES

1. Electromagnetic Acoustic Transducers (EMAT). McDermott Technology, Inc. Research and Development.

REVIEWERS

Peer reviewed as an emerging construction technology

DISCLAIMER

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