Non-destructive Testing [NDT]

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Non-destructive Evaluation [NDE] techniques

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Introduction

Nondestructive testing (NDT) of materials offers many advantages over destructive testing, including cost savings and improved product quality, since more pieces can be inspected without significantly increasing operating costs (Hellier 2001, p. 14). As a result, many NDT techniques have been developed over the years.

Types of NDT

The most frequently used testing methods are (Peter 2002, p.9):

- Radiographic Testing
- Gamma Radiographic Testing
- Accelerator – High Voltage Radiographic Testing
- Ultrasonic Testing
- Eddy Current Testing
- Dye Penetrant Testing
- Magnetic Particle Testing
- Visual Testing
- Leak Testing

Eddy Current Testing

Eddy Current Testing (ECT) can be used on electrically conductive material for detecting and characterizing defects such as surface and near surface cracks, gouges, and voids. It can also be used to verify a material's heat treat condition (Hellier 2001, p.67). In addition, wall thickness of thin wall tubing, and thickness of conductive and nonconductive coating on materials can be determined using ECT.

As per ASTM E426-9, when testing tubing with encircling or saddle type coils, LID defects have been detected on ½ in. (12.7 mm) wall carbon steel and stainless steel material. Depth of penetration is defined as the point where the eddy current density has decreased to 37% of its surface value. On carbon steel tube, which has been magnetically saturated, a typical penetration depth using a test frequency of 10 kHz is around 0.120 in. (3 mm).

Advantages

The following are the specific advantages of using this method (Kutz 1986, p.26):

1. High speed testing (can be automated)
2. Accurate measuring of conductivity
3. High-sensitivity to small discontinuities
4. Discontinuities at or near surface can reliably detected
5. Accurate coating thickness measurements
6. Direct Go/No Go answers can be quickly
7. No physical contact required
8. Low cost
9. Portable

Disadvantages

The following are some of the disadvantages of using this method (Kutz 1986, p.29):

1. Limited penetration into test article
2. Several variables simultaneously affect output indications
3. Discontinuities are qualitative not indications
4. Material must be conductive

5. Requires skill when many variables are obtained involved
6. False indications can result from edge and parts geometry

Limitations

There are three major factors that affect ECT. These are material conductivity, geometry, and permeability of the material being tested (Kutz 1986, p.33).

Conclusion

Eddy Current Testing is a fast, reliable, and cost effective nondestructive testing (NDT) method for inspecting round, flat, and irregularly shaped conductive materials. Specific processes have been developed to determine the usability and integrity of threaded fasteners. In addition, ECT has the capability of being automated. With proper equipment and skilled test technician's readout is instantaneous (Kutz 1986, p.34).

Bibliography

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