



# National Institute of Standards & Technology

## Report of Investigation

### Research Material 8458

#### Artificial Flaws for Eddy Current Nondestructive Evaluation

This Research Material (RM), the Capobianco, Dube, Fizer (CDF) notch, provides a reproducible flaw of a known size and geometry that closely resembles an actual fatigue crack. It is intended to produce a response suitable for calibrating an eddy current nondestructive evaluation (NDE) system.

#### Material Preparation

The starting material is a 7075-T651 aluminum alloy annealed to the 0 temper. A thin tool, shaped to the desired length, depth, and geometry, is pressed into specimen which is then annealed once more to remove the effects of cold working from the notch area. The specimen block is then compressed in a direction transverse to the length of the notch until the notch appears tightly closed. Any necessary surface finishing is performed, then the block is heat treated to the T6 temper. The flaw size is  $3.0 \pm 0.1$  mm long, nominally 1.0 mm deep, and the geometry is part circular.

#### Probe Construction

The impedance values measured on this material were produced with an air core coil. This coil is wound with # 48 AWG wire with double build insulation and a total outside diameter (with insulation) of  $0.0394 \pm 0.0038$  mm. The coil itself has the following dimensions:

Outside diameter	- $1.067 \pm 0.127$ mm
Inner diameter	- $0.508 \pm 0.013$ mm
Length	- $1.092 \pm 0.051$ mm
No. of layer	- 8
No. of turns	- $200 \pm 4$

The separation between the coil and the specimen block during scanning (lift-off) is 0.254 mm. The probe is wired using a one meter length of RG 174 coaxial cable terminated with a BNC connector.

#### Impedance Measurement Procedure

Four measurements are taken off the flaw on the flat-faced flaw-side of the block. The on-flaw measurement is taken by moving the probe to the point on the flaw where the highest impedance reading is obtained. The four off-flaw readings are averaged and subtracted from the on-flaw value, in rectangular coordinates, to calculate the impedance change. The impedance values were taken at 500 kHz with an ambient temperature of  $20 \pm 1$  °C ( $68 \pm 2$  °F).

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### Impedance Change Value ( $\Delta Z$ )

The 90% confidence interval for the mean  $\Delta Z$  is reported using the probe construction and procedure outlined above and three repeat measurements.

On CDF notch serial no. \_\_\_\_\_, the value of  $\Delta Z$  obtained is \_\_\_\_\_  $\pm$  \_\_\_\_\_  $\Omega$ .

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