

Flaw inspection using GMR magnetic leakage flux test

Challenge

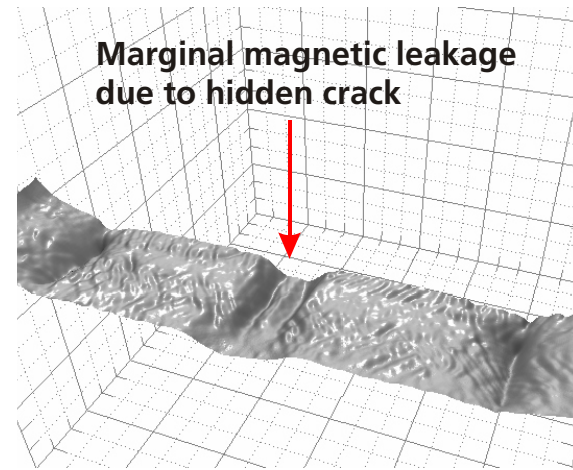
- Dry flaw inspection in contrast with conventional magnetic particle testing
- Objective defect evaluation

Solution

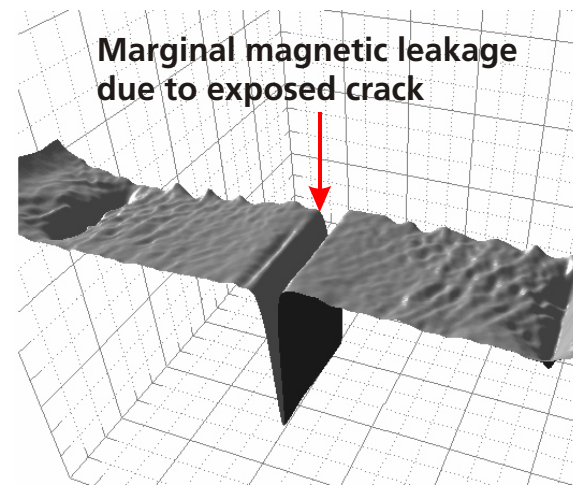
- The new flux leakage inspection method is based on the use of Giant-Magneto-Resistance (GMR) sensors
- The flaw is detected by the flux leakage on the surface of the piece being inspected
- Manipulator-supported inspection of the test object

Advantages:

- Touch-free measurement, few wearing parts
- Automated flaw detection, including objective defect evaluation
- Use of sensor arrays consisting of low cost GMR-Arrays
- Detection of hidden faults



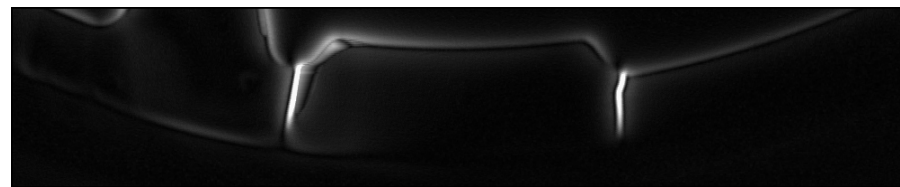
Scan of a covered steel crack, crack depth 1 cm, 1 cm vertical cover



Scan of a vertically covered steel crack, crack depth 1 cm



Cracks (red arrows) in an inductively tempered component from the automotive industry



Visualization of the leakage flux caused by cracks

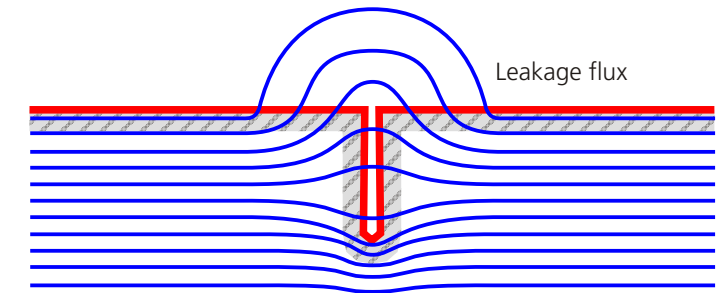
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Situation

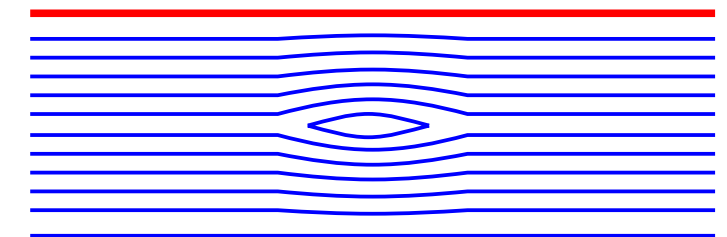
- Increased quality requirements in fabrication can frequently be safeguarded by the use of non-destructive testing processes. Crack detection plays a major role here. The most frequently used process is manual or (semi-) automatic leakage testing with magnetic particles and optical evaluation. Optical processes require a high level of personnel effort. Subjective influences can not be excluded.

Practice

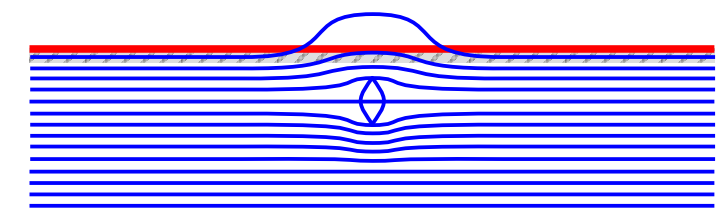
- The magnetic field curves in magnetized material are deflected at potentially existing material separations, e.g. cracks. Flaws that are vertical to the direction of the magnetic field have the largest influence. In the case of faults that are close to the surface, this causes a local increase in the tangential intensity of the magnetic field at the surface of the component that is being tested. These tangential magnetic field ratios can be recorded with the help of Giant-Magneto-Resistance (GMR) sensors. The Giant-Magneto-Resistance effect is based on the drastic decrease in the electric resistance of the material the probe consists of, when the probe is located in an external magnetic field.



Separation joint on surface, vertical to electric flux lines

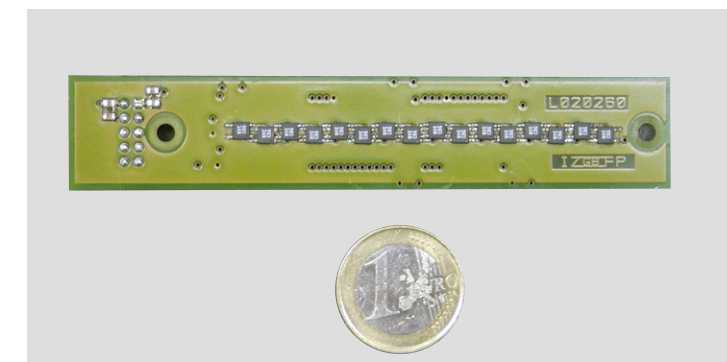


Fault within interior of material, parallel to electric flux lines



Fault within interior of material, vertical to electric flux lines

Physical basis of the principle



GMR sensors