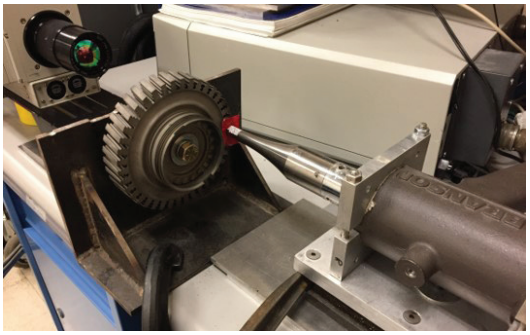
DYNAMIC MECHANICAL STRAIN-INDUCED TEMPERATURE GRADIENT COATING

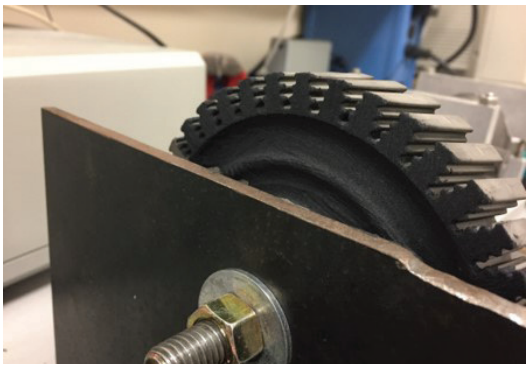
Patent Pending
SD# 14194
Technology Readiness Level: 3
Concept demonstrated analytically or experimentally

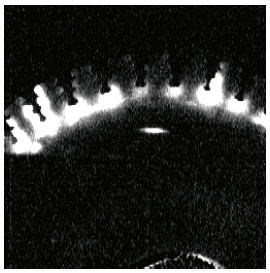
A non-destructive coating to reduce false negatives during sonic infrared (SIR) inspection by visualizing regions of dynamic thermal strain

Evaluating a component for discontinuities without damaging it remains a priority for diverse industries and research fields. Low-cost evaluation techniques such as fluorescent penetrant inspection (FPI) are in widespread use by major industries, such as aviation and aerospace, despite limited defect detection and the need for complex, multi-step operations in highly controlled conditions. Non-destructive methods such as sonic infrared (SIR) testing, which applies ultrasound waves to identify surface defects and cracks, holds promise for widespread use but stands to improve in the detection of false negatives.

Sandia researchers developed a non-destructive coating to visualize regions of strain and reduce false negatives during sonic infrared (SIR) inspection. This coating may be helpful in making SIR a viable alternative to widely used dye-based methods, such as FPI. Applying a simple coating containing black paint and glass particles to a component or substrate increases emissivity of its surface. By introducing dynamic mechanical strain such as SIR to the coated substrate, the adhered particles generate frictional heating. The resulting localized temperature increases can then be measured with an infrared camera to verify that the entire part was vibrated and thoroughly inspected. In addition to enhancing SIR-based non-destructive testing, this coating has potential applications in structural monitoring of bridges and buildings, modal testing of parts, and as a replacement for accelerometers to detect where vibrations are occurring.







Above: An infrared camera and an ultrasonic horn (21 kHz) inspects a coated engine part. At left, the resulting thermal image show areas of dynamic thermal strain within the engine part.

TECHNICAL BENEFITS

- Non-destructive testing (NDT)
- Enhances effectiveness of sonic infrared (SIR) inspection techniques
- Visualizes localized temperature increases to ensure adequate dynamic thermal strain across the part during inspection

INDUSTRIES & APPLICATIONS

- Aerospace
- Automotive
- Infrastructure
- Structural health monitoring
- Modal testing and analysis
- Marine and maritime
- Military and defense
- Pipelines
- Shipping and logistics

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