

Development of a high sensitivity ultrasonic phased array non-destructive testing method for early detection of creep damage in alloy steels used in high temperature/CreepTest

the objective of the project

To develop a rapid, cost effective Non-Destructive Testing system, techniques and software that will be robust and easy to deploy on site to reliably detect and evaluate insipient or early stage creep damage.

Quantify results to assess the extent of creep detection and categorise into (i) cavitation formation, (ii) cavitation coalescence, (iii) formation of micro-cracking and (iv) macro-cracking.

To demonstrate the NDE systems performance on in-service, in-situ steam pipe welds and to validate the technique results against representative samples containing realistic creep defects.

motivation

Creep is the time-dependent, thermally assisted deformation of the component operating under stress. Metal pressure components such as boiler tubing, headers, and steam piping in fossil-fired power plants operate at thermal conditions (above 538°C) conducive to causing creep damage over the operating life of the component.

To ensure safe and reliable operation of such components in service, utilities periodically use non-destructive evaluation techniques to inspect these components for damage. These inspections are largely targeted at detecting late stage creep damage in which cracking is active in the component and provides qualitative rather than quantitative data.

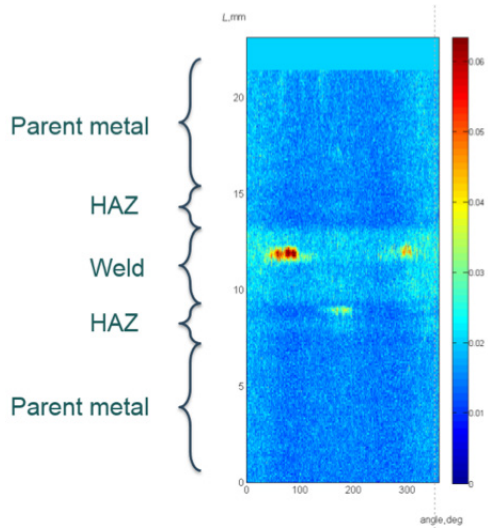
Recent advances in NDE technology have provided enhanced capabilities for incipient creep failure detection. CreepTest will seek to apply time reversal focusing and full matrix capture techniques that have already shown a capability to identify early stage creep damage. A library of the defects will be produced with the aim of providing inspection limits and the probability of detection for the techniques developed in the project and thus enable accurate life cycle prediction of components under inspection.



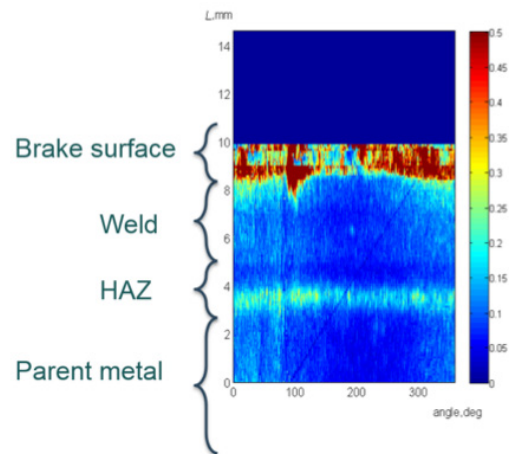
1st unbroken reference sample with the creep damage inside the weld



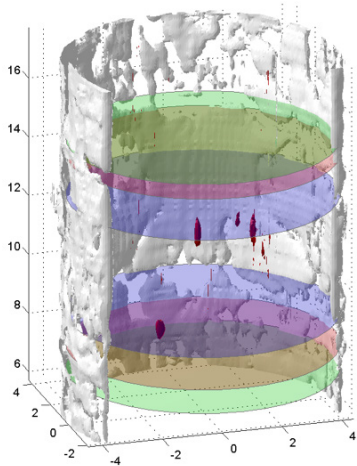
2nd reference sample after the breakage due to the development of the creep damage



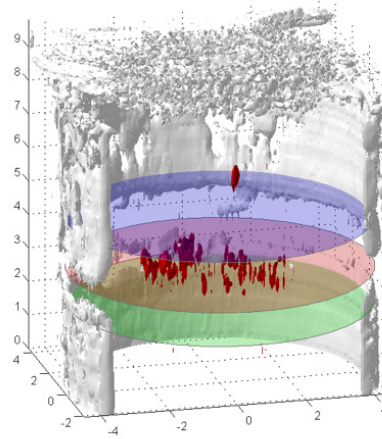
The B-scan of the 1st reference sample showing the structural noise along different regions of the sample and indicating start of creep damage



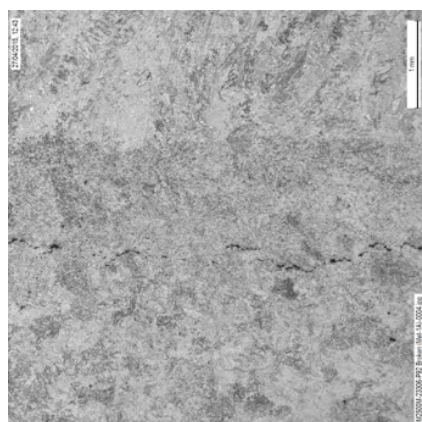
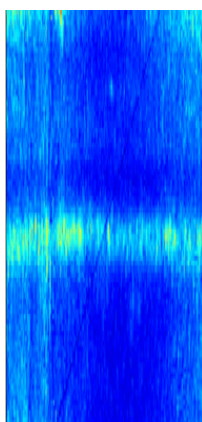
The B-scan of the 2nd reference sample showing the structural noise along different regions of the sample and indicating strong creep damage



Reconstructed 3D ultrasonic image of the 1st sample



Reconstructed 3D ultrasonic image of the 2nd sample



Comparison of ultrasonic (left) and metallographic (right) images

project partners

Applied Inspection LTD (United Kingdom), Acutech Eisagoges Antiprosopieis EPE (Greece), INETEC (Croatia), TWI Limited (United Kingdom), National Technical University of Athens (Greece), SSE PLC (United Kingdom), Kaunas University of Technology (Lithuania).

project homepage:

<http://www.creep-test.com/>