TCR Advanced Engineering P. Ltd
Experts in Metallography, Failure Investigation and RLA

Metallurgy for Industries

Power | Petrochemical | Fertilizer | Chemical | Refinery | Engineering | Automobile

A Monthly News Letter December, 2014 **Volume 24**

Gauging depth of surface crack

A Nondestructive testing technique

Cracks are, according to the definition, a clean (crystalline) fracture passing through or across the grain boundaries and may possibly follow inclusions of foreign elements. Cracks are normally caused by overstressing the metal during forging or other forming operations, or during heat treatment. Where parts are subjected to significant reheating, cracks usually are discolored by scale. It is a narrow material partial separation or a break without complete separation of parts.

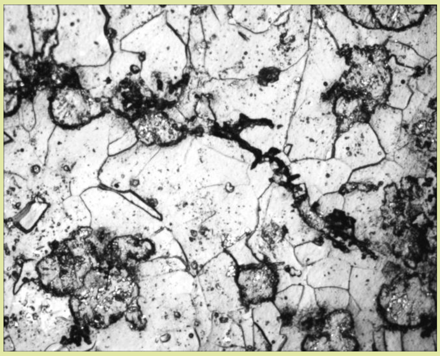
The crack mainly is sharp at its ground, i.e. it forms a sharp notch. In case of mechanical stress, mainly under alternating or changing load, tension at the ground of notch occurs, leading to crack growth. In this case a condition is developing, wherein the cross section reduces to an extent that it cannot withstand the load and leads to fracture. Therefore in case of cracks, always extreme caution is required. Therefore an early detection and evaluation of cracks is of great importance, especially for surface cracks.

Volumetric NDT methods like UT (Advanced UT – PAUT and TOFD) can be used to detect the depth of internal cracks and surface cracks which have penetrated quite deep in to the material. Surface NDT methods like PT and MT are most reliable for detection of surface and subsurface cracks up to certain mm of depth (by MT). With both methods (MT and PT), the surface indication is wider than the actual crack opening. Therefore, even if a visual test fails, the crack is reliably detected with high contrast with both methods. Despite being most reliable methods for detection, MT and PT cannot provide depth of cracks.

As a part of constant endeavor to increase the reliability of non-destructive testing to industry, TCR Advanced has a German crack detector based on principle of potential drop for detection of depth of crack.

Microstructure of the Month

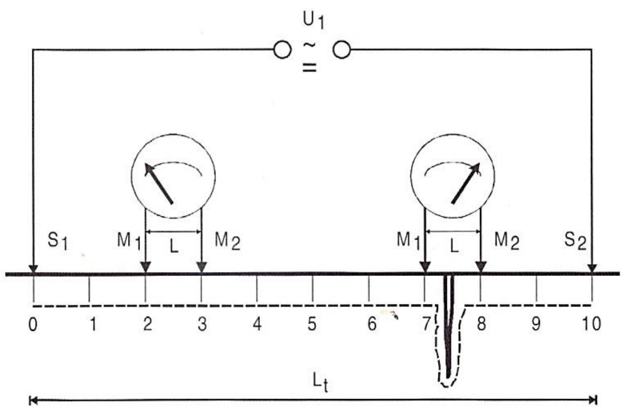
• • •



Magnification: 200X
MOC: EN-JS1059
Component: Stationary blade casing
Observation: Microstructures after replication metallography shows nodular cast iron in ferrite and pearlite matrix. The crack is observed to have traversed through graphite nodules forming a branched network.
Cause: The network of cracks observed during inspection of the casing were due to effect of graphitic corrosion at the portion of degraded graphite structure limited to surface at depth of up to 500 µm.
Useful hints: Proper foundry practice needs to be followed to ensure damage free nodular graphite throughout the cross section. This can be ascertained by in-situ metallography on actual casting. The purity of steam quality needs to be ascertained. It is also advised to check the water quality used for makeup / steam condensate circuit. Measure of conductivity at exit of steam condenser would provide early warning on contamination.

Principle of testing:

Between two equidistant, a flawless partial sections within the total length Lt passed by the current, nearly identical potentials can be measured. The fact that close to the contacts S1 and S2 certain changes occur due to the compression of current path can be neglected. If as crack is positioned between the current contacts, like in fig. 1 between the partial areas 7 and 8, the current lines are forced to run around it, as the open crack filled with non- conductive materials prevents the current from passing through. The extended path of the current and around the crack increases the voltage drop measured between M1 and M2. The value is increasing with growing crack depth. In brief this principle is used to judge upon a crack depth for measuring voltage between two measuring contacts. Therefore this method is briefly called potential probe method. Following figure illustrates the principle of crack detection.



Applications:

This technique finds its applications in industries like forging, foundry, heat treatment shops, fabrication industries, in-service inspection of plants and other components. The estimation of crack depth can be useful for deciding repair and/or rejection. Typical Measuring Range is 0 mm to 99 mm for ferrous materials and 0 mm to 12 mm for aluminum, copper and brass. Typical measurement accuracy for a two-point material correction on Ferromagnetic material is 3 to 15% and on austenitic materials is 3 to 25%.

TCR can provide services of crack depth measurement at site.

* * *

For Further details Contact us at testing@tcradvnaced.com , Ph: +91-7574805595