TCR Advanced Engineering P. Ltd

Experts in Metallography, Failure Investigation and RLA

Metallurgy for Industries

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

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Demagnetisation of Rotating Components

An introduction.

Magnetization

Magnetism in rotating components accounts for many previously unexplained machinery failures. In particular, the deterioration of bearings, seals, gears, couplings and journals has been attributed to electrical currents in machinery. Often, such trains or machinery groupings contain no components with electrical windings or intended magnetism.

The evolution of turbine and compressor systems towards high speeds and massive frames is acknowledged as the cause for a new source of trouble from magnetic fields.

A turbine, compressor, or any other rotating machine that is magnetized behaves as an electrical generator. The magnetic steel parts provide a magnetic circuit, and are also electrically conducting so that voltages are generated, producing localized eddy currents and circulating currents. These currents will be either alternating or direct, and can spark or discharge across gaps and interfaces, producing sparking with frosting, spark tracks, and, in the extreme, welding. They can cause increased temperatures and inflict or initiate severe damage.

The generator action occurs as a result of relative movement between the magnet and the "conductors." Hence, either the frame of a machine or the rotor can be magnetized and the same action exists when relative motion occurs between the rotating and stationary parts.

Potential causes of residual magnetism

The residual magnetism in rotary components occurs not from design but from manufacturing, testing, and environmental causes. They have been measured at the surface and in gaps of disassembled parts of a machine at levels from 2 gauss to thousands of gauss. These increase significantly in the assembled machine where the magnetic material provides a good closed path for the magnetism and the air gaps between parts are reduced considerably. This combination can set up conditions for generation of notable stray voltages and the circulation of damaging currents.

- Magnetic particle Examination (MPI), A common NDE technique used for identification of surface and subsurface flaws in ferromagnetic materials. It uses strong magnetic fields for identifying defects this could cause residual magnetism in the components if not properly degaussed.
- Use of magnetic tools for assembly of the rotary equipment may produce residual magnetism at localised regions.
- Current flows during electric arc welding generates a magnetic field in a material if any rotating component is operating in close proximity of this field then it may get magnetised.
- Welding for Repairing/refurbishment of rotary components without effective grounding path can also cause partial or complete magnetisation of components.
- Stray electrical currents often produce residual magnetism due to improper installation of grounding brush in rotating component.

TCR News

- Mr. A. K Singh, President (Power Plant & Turbine) delivered the keynote address at 12th National Conference on Indian Energy Sector "Synergy with Energy" held on 14th - 15th July 2017. The event was attended by large number of energy sector professionals from all over the country.

- TCR completed testing of critical FFS job of HF Reactor at SRF limited, Dahej.
- Conducted training on Selection of NDT Techniques and Reformer Tube: Damage Mechanisms, Failure Investigation, Inspection and Remaining Life Assessment (RLA) at its state-of-the-art training center 'Evolve'.

EVOLVE by TCR

- Added new equipment for Clad and Weld Overlay Thickness Measurement. TCR can provide cladding thickness measurement up to 25 mm thickness.

- Completed more than 15 site visits for material identification for the prestigious project "Statue of Unity" at Kevadia.

STATUE OF UNITY
एक भारत, श्रेष्ठ भारत

- Improper shielding of electrical cables causes magnetic field, this can induce a residual magnetism in nearby rotating components.

Effects of residual magnetism

Residual magnetism in rotating components can cause damages such as metal loss, frosting, grooving and burning marks. These damages can seriously affect the performance of the equipment and put its integrity at question. It sometimes causes higher vibrations than its normal operating behavior. Magnetised component attracts external ferromagnetic particles at critical areas such as bearing area. This causes abrasion and increased wear. Rotating magnetic field induces stray current in material which produces excessive heat. Residual magnetic field and stray currents due to it can interfere with sensitive instrumentation causing it to be malfunction.

Methods of Demagnetization

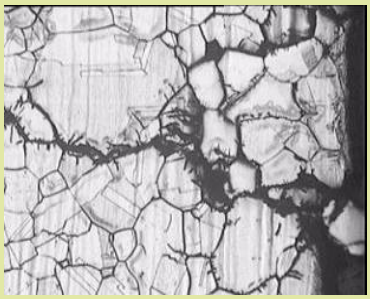
The ease of demagnetization is dependent on the coercive force of the metal. High retentivity is not necessarily related to high coercive force in that the strength of the residual field is not always an indicator of ease of demagnetizing. In general, demagnetization is accomplished by subjecting the part to a field equal to or greater than that used to magnetize the part and continuously reversing the field direction while gradually decreasing it to zero.

- **Withdrawal from Alternating Current Coil**—The fastest and most simple technique is to pass the Component through a high intensity alternating current.
- **Decreasing Alternating Current**—in this technique the component is subjected to the field while gradually reducing its strength to a desired level.
- **Demagnetizing With Yoke**—Alternating current yokes may be used for local demagnetization by placing the poles on the surface, moving them around the area while it is still energized.
- **Reversing Direct Current—**This is the most effective process of demagnetizing large parts in which the alternating current field has insufficient penetration to remove the internal residual magnetization.

The effectiveness of the demagnetizing operation can be indicated by the use of appropriate magnetic field indicators or field strength meters.

TCR has team of experienced engineers and state of the art DEMAG equipment and instrumentation for residual magnetic field measurement. We offer demagnetization services for all types of components. We can mobilize our personnel at extremely short notices.

Microstructure of the Month



Magnification: *100X*
MOC: ASTM A403 Gr.304H
Component: Reformer tube
Observation: IGSCC is noticed in the general microstructure of austenite. The cracking is associated from ID and showing mainly inter-granular stress corrosion cracking. Microstructure shows heavy carbide precipitation at grain boundaries in oxalic acid etched condition.
Cause: The failure of reformer tube from stub side HAZ has occurred by polythionic acid inter-granular stress corrosion cracking from ID side.

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