TCR Advanced Engineering P. Ltd

Experts in Metallography, Failure Investigation and RLA

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Ferrite content measurement in AS and DSS

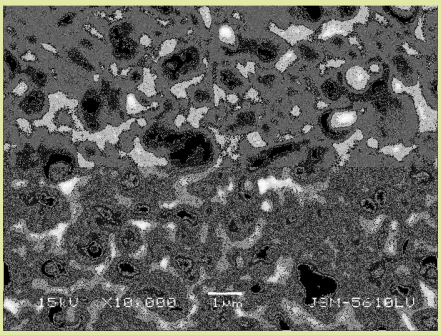
An application of ferritoscope

Stainless steels have excellent weldability- having said that it is very much important to control the ferrite content in welding of austenite as well as duplex stainless steel. Fully austenitic stainless steel welds are susceptible to cracking in a single pass or underlying weld runs reheated by subsequent weld pass. Welds susceptible to such cracking may be avoided by using welding electrodes/filler wires with composition and environmental conditions that allow delta ferrite to form in the weld pool. But in certain cases/corrosive conditions ferrite may lead to preferential corrosion attack and hence fully austenitic weld is desired. (Ex- urea grade 316). Also, increase in ferrite content results in decrease of toughness/ductility. In any of the cases monitoring ferrite content in austenitic stainless steel weld becomes very important.

Duplex stainless steel in cast or wrought form consists mixture of phases of ferrite and austenite respectively. The mixture of phases increases the utility value of steel from various temperature ranges from -46^{o} C to as high as 260^{0} C. Their yield strength is around double that of austenitic stainless steel; whereas ductility and toughness approach to austenitic stainless steel. Resistance to chloride stress corrosion cracking of duplex stainless steels is near to ferritic stainless steel. The desired properties can be achieved by different combinations of ferrite and austenite. The desirable microstructure in duplex stainless steel – cast or wrought, can be controlled by chemical composition and/or heat treatment. When welding duplex steel, the ferrite content in the welding area can easily assume unfavorable values either due to unsuitable welding filler materials or through poor heat input or heat removal. Hence, it is required to monitor the ferrite content in duplex stainless steel weld whether it is wrought or cast to get the desired final intended properties.

Ferrite content in austenitic and duplex stainless steel by non – destructive method is very easy and accurate.

Microstructure of the Month



Magnification: 1000X

Etchant: Villela's Reagent

MOC: Martensitic stainless steel (X46Cr13)

Component: Vacuum Hardening & Sub-Zero Heat-Treatment Sample.

Observation: Image shows fine tempered martensite structure with rounded alloy carbides at the facets of martensite regions. Fine precipitations of eta carbides are observed evenly distributed in the microstructure.

Useful hints: Presence of eta carbides would improve the wear resistance and stability of the microstructure.

This is especially helpful in monitoring the ferrite content during fabrication or 100% checking of wrought products. Ferrite content is measured in % ferrite or FN (ferrite no.)

Principle of ferrite measurement:

Ferrite meter measures ferrite by magnetic induction method. A magnetic field generated by a coil begins to interact with the magnetic portions of the specimen. The changes in the magnetic field induce a voltage proportional to the ferrite content in a second coil. This voltage is then evaluated. All magnetic portions in the otherwise non-magnetic structure are measured, i. e., in addition to delta ferrite and other ferritic portions such as strain-induced martensite.

A specific advantage of the magnetic induction method for measuring the ferrite content is that sigma phase, which is Fe-Cr precipitation, formed due to excess ferrite content and unfavorable cooling conditions, is recognized correctly as a non-ferritic structural component. This leads to erroneous interpretation of ferrite content in a metallographic section where a sigma phase is not easily distinguished from a ferritic structure. Ferrite Meter measurements is nondestructive test technique and highly popular.

TCR Advanced provides services for ferrite measurement using state of the art equipment Fischer make - FERITSCOPE® FMP30 with standard calibration samples. The equipment offers Non-destructive measurement of the ferrite content in a range from 0.1 to 80 % Fe or 0.1 to 110 FN. Display reads units of measurement switchable between WRC-FN and % Fe

The FERITSCOPE FMP30 measures the ferrite content in austenitic and duplex steel according to the magnetic induction method. It is suited for measurements according to the Basler-Standard and according to DIN EN ISO 17655. Areas of application are onsite measurements, e. g. of austenitic plating as well as weld seams in stainless steel pipes, containers, boilers or other products made of austenitic or duplex steel.

It is easy to measure the ferrite content accurately when using the FERITSCOPE FMP30. The reading is displayed automatically by just placing the probe on the test surface. We can also find weld seams in polished surfaces without etching, by scanning the surface with the probe. A change in the ferrite content reading shall indicate that the weld seam is present. For easy ferrite content measurements along a weld seam, the instrument offers the "continuous measurement capture" function. When scanning the weld seam with the probe positioned, the continuous readings are captured and stored. This provides a ferrite content profile along the weld seam.

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