FERITSCOPE® FMP30 Measurement of the Ferrite Content

in Austenitic and Duplex Steel

Measurement of the Ferrite Content

Chemical, energy and processing plants are often subject to heat, aggressive media and high pressure. These circumstances demand steel with high corrosion and acid resistance that are resilient even at high temperatures. If the ferrite content is too low, then the welded material is susceptible to hot-cracking, if the ferrite content is too high, the toughness, ductility as well as the corrosion resistance of the steel are reduced. For duplex steel, a ferrite deficit in the area of the weld seam results in stress corrosion cracking and reduction in strength.

The FERITSCOPE FMP30 measures the ferrite content in austenitic and duplex steel according to the magnetic induction method. All magnetisable structure sections are measured i.e., in addition to delta-ferrite also strain-induced martensite, for example, or other ferritic phases.

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 platings as well as weld seams in stainless steel pipes, containers, boilers or other products made of austenitic or duplex steel.

Duplex steel is used increasingly in the chemical and petrochemical industries, e.g., for boilers and pipelines. A ferrite deficit in the weld seam area leads to strength reduction, an excess ferrite content to a reduction in toughness and ductility.

In particular when welding duplex steel, the ferrite content in the welding area can easily assume unfavourable values either due to unsuitable welding filler materials or through poor heat input or heat removal. Only an onsite measurement can provide the assurance that the processing did not change the optimum ferrite content in an unfavourable manner at the expense of mechanical or corrosion-resistance properties.

Measurement of the ferrite content of a weld seam

Simple and quick measurements
It is easy to measure the ferrite content accurately when using the FERITSCOPE FMP30. Upon probe placement on the surface of the specimen, the reading is displayed automatically and stored in the instrument. The probe can also be placed onto hard to reach areas. For such applications, the instrument features an "external start" function to trigger the measurements with the push of a button. This is ideal for measurements in pipes, bore holes or grooves.

Finding weld seams in polished surfaces is made easy through the "continuous display" instrument function. When scanning the surface with the probe with this function enabled, the continuous readings are displayed only. A change in the ferrite content reading indicates that the weld seam has been found.

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.

Measurement influencing factors do not significantly affect the FERITSCOPE FMP30. Ferrite content measurements can be carried out regardless of the substrate material properties starting at a plating thickness of 3 mm.

Corrective calibrations with customer-specific calibration standards or correction factors (included) can be used to take influences of the specimen shape (strong curvature), plating and substrate thicknesses into account. The calibration is always stored measurement-application specific in the respective application memory.

Determination of the ferrite content in the weld seam area using the FERITSCOPE FMP30

FERITSCOPE® FMP30

Bluetooth®

Instrument features

- User-friendly operation menu
- Multiple language selections
- Large, easy to read colour display
- Robust housing
- Non-destructive measurement of the ferrite content in a range from 0.1 to 80 % Fe or 0.1 to 110 FN
- Units of measurement switchable between WRC-FN and %Fe
- Automatic probe recognition
- Sliding cover for keypad; however, On/Off and evaluation keys remain accessible at all times
- Protection of settings though lockable keypad
- Battery or line operation
- Automatic instrument shut-down or continuous operation

Measurement capture

- Fast measurement and data storage
- Automatic measurement acquisition upon probe placement or through "external trigger"
- Enabled or disabled acoustic signal
- Overwriting of erroneous measurements or previously stored readings
- Selectable tolerance limits
- Measurement data presentation as an analog bar with display of specification limits
- Continuous display: Continuous display of the reading when probe is placed on the specimen; storing with externally triggered measurement acquisition
- Outlier rejection function for the automatic elimination of erroneous measurements
- Matrix measurement mode: Measurement data storage in blocks that are set up in the application in the form of a matrix. Block change manually or automatically in the specified sequence
- Measurement data averaging: Only the mean value of a specified number of single readings is stored
- Automatic block creation: Number of single readings per block
- Area measurement: Continuous measurement acquisition until the probe is lifted off; only the resultant mean value is stored
- Continuous measurement acquisition and storage with the probe placed on the specimen

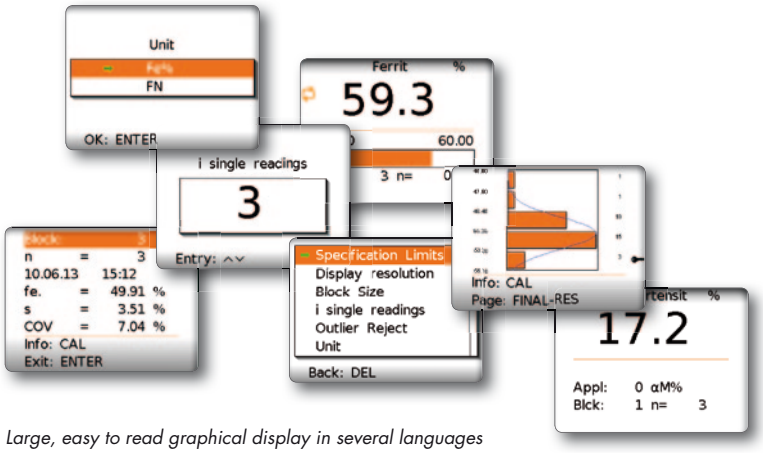
Simple and convenient evaluation of measurement data through data transfer via Bluetooth® or cable

Data memory
- Up to 20,000 readings and 100 applications for measurement data and application-specific calibrations
- Separation of the measurement data in up to 4,000 blocks
- Date and time stamp for the blocks

Evaluation
- Statistical evaluation of measurement series with mean value, standard deviation, max and min value, range
- Computation of the process capability indices c_p and c_{pk}
- Output of characteristic variance-analytical values
- Graphical measurement presentation as a histogram with a Gaussian bell curve

Interfaces
- USB port for data transfer to a PC or printer
- Optional Bluetooth® module, interface for wireless data transfer to a PC (up to 10 m)
- Optional COM module, serial interface for data transfer to a PC or printer (cable length up to 12 m)

Calibration
- Only one calibration required for the entire relevant measurement range from 0.1 to approx. 90 FN. Adherence to the measurement accuracy specified in standard ANSI/AWS A4.2M/A4.2:1997
- Calibration using calibration standards traceable to TWI secondary standards or customer-specific standards
- Linking applications: Common normalisation/ calibration of applications



Large, easy to read graphical display in several languages

Calibration and measurement method

Calibration / Standards

To obtain comparable measurement results, the instruments must be adjusted or calibrated using standards that can be traced to internationally recognised secondary standards. For this purpose, the IIW (International Institute of Welding, UK) developed secondary standards that have been determined by the TWI (The Welding Institute, UK) according to the method described in DIN EN ISO 8249 and ANSI/AWS A4.2.

Helmut Fischer offers certified calibration standard sets that are traceable to the TWI secondary standards for corrective and master calibrations. The standards of the FISCHER calibration standard sets list in addition to the ferrite numbers FN also the % Fe values.

Influences including the shape of the part to be measured (strong curvature, thickness of the ferrite-containing coating, etc.) can be taken into account through corrective calibrations with customer-specific calibration standards or through correction factors (included). The normalisation and corrective calibration are stored application-specific in the respective application memory of the instrument.

Magnetic induction method

The FERITSCOPE FMP30 measures according to the 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 also strain-induced martensite, for example.

A specific advantage of the magnetic induction method for measuring the ferrite content is that a sigma phase, i. e., a Fe-Cr precipitation, which has formed due to excess ferrite content and unfavourable cooling conditions, for example, is recognised correctly as a non-ferritic structural component. In comparison, erroneous interpretation of ferrite content is likely in a metallographic section where a sigma phase is not easily distinguished from a ferritic structure.

FISCHER calibration standard set with certificate

Standard content of shipment	Order no
FERITSCOPE FMP30 instrument, wrist strap, case, battery set, short form operating instructions printed, operator's manual and USB driver on CD, interface cable FMP/PC	605-026

Probes with a measurement range 0.1 – 80 %Fe or 0.1 – 110 WRC-FN

FGAB1.3-Fe	For measurements on flat and curved areas	604-264
FGABI1.3-150-Fe FGABI1.3-260-Fe	Ideal for measurements in pipes, bore holes or grooves Insertion diameter > 9 mm Shank length = 150 mm or 260 mm	604-254 604-341
FGABW1.3-Fe	Angle probe for measurements on flat specimens or in pipes, bore holes and gaps	604-337

Calibration standard sets

Corrective calibration standard set CAL-NS %Fe-WRC 0.3/10 includes standards about: 0.4, 2 und 9 FN (0.4, 2.5 and 10.5 %Fe)	602-279
Corrective calibration standard set CAL-NS %Fe-WRC 1.5/30 includes standards about: 2, 9 und 33 FN (2.5, 10.5 und 30 %Fe)	602-239
Corrective calibration standard set CAL-NS %Fe-WRC 10/80 includes standards about: 9, 33 und 110 FN (10.5, 30 und 80 %Fe)	602-277
Corrective calibration standard set CAL-NS %Fe-WRC 0.3/80 includes standards about: 0.5, 2, 13, 33 und 90 FN (0.5, 2.5, 14.5, 30 und 63 %Fe)	602-776

Optional accessories

Adapter E-probe/F-socket	604-214
AC adapter FMP30-40	604-290
Rechargeable battery set FMP (NiMH)	604-295
Battery charger AA/Mignon	604-335
Bluetooth® USB stick, for retrofitting the PC with Bluetooth interface	604-481
Printer handheld devices FPT100	604-412

Instrument upgrade

Bluetooth® Module FMP30/40, interface for the wireless data transfer from the instrument to a PC (max. 10 m)	604-480
COM Module FMP30/40, serial interface (RS232) for data transfer to a PC or printer (max. cable length 12 m)	604-500

Spare parts

Wrist strap FMP	604-150
Interface cable FMP/PC	604-146
Battery set FMP (Alkaline)	604-296
Instrument case FMP	604-148

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