PRESS RELEASE

Inclusion Detection System (IDS)

Early detection of inclusions in cold-rolled strip steel

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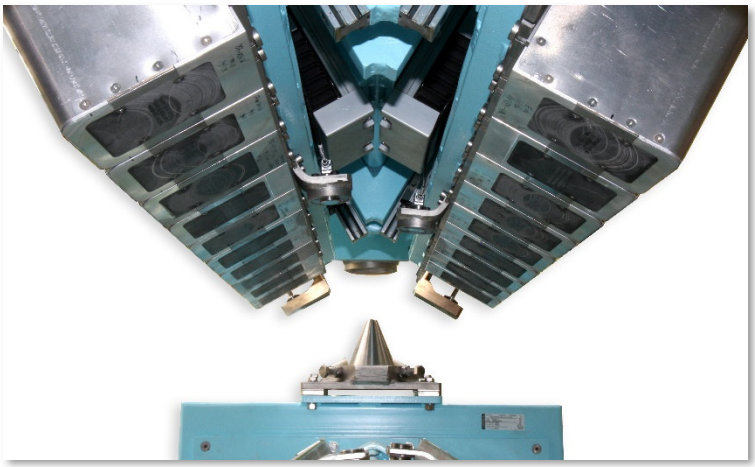

Inclusions in cold-rolled steel strip hold a high risk potential for further processing involving high degrees of deformation

Thin, cold-rolled strip steel can contain internal inclusions or hidden shell defects that are not critical for most further processing. However, if such a thin sheet is processed further by, for example, deep-drawing – and thus with high degrees of deformation – these internal defects can lead to material fracture, considerably disrupt the production process and even cause expensive damage to tools.

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The ability to detect and evaluate such internal material defects already during the strip production process enables manufacturers to classify the material produced specifically and identify potential difficulties in further processing at an early stage.

This gave rise to a wish amongst customers for a system to detect internal defects to enable them to supply qualitatively perfect end products. This minimises not only customer complaints, but also the producers' scrap rate, while at the same time optimising product quality.

To meet this customer requirement, IMS Messsysteme GmbH developed a detection system based on the principle of magnetic leakage flux to detect and visualise internal defects: the Inclusion Detection System (IDS).

"Even the smallest, non-metallic inclusions can lead to serious problems in further processing at our customers. The ability to detect and precisely evaluate such defects in the material during ongoing production is therefore essential for delivery of high-quality end products. The challenge for IMS Messsysteme GmbH to develop a technically powerful system exactly tailored to our requirements is accordingly high.

The first tests of the inclusion detector installed in our plant have already met our expectations to the full! The detection and visualisation – and thus the possibility of evaluation – of non-metallic inclusions by this novel system are impressive." (– Anonymous quote from a reference customer in the steel industry)

Field of application and functional principle of the Inclusion Detection System (IDS)

The Inclusion Detection System (IDS) is the latest high-tech development from IMS. The intelligent measuring system, which is based on magnetic leakage flux (MLF), detects and analyses internal material defects such as non-metallic inclusions (NMI) and hidden shell defects at speeds of up to 1,000 m/min.

The latest test results show that inclusions are already detected reliably in sheets with a thickness of up to 0.5 mm. It is the internal goal of IMS to also provide manufacturers of sheets up to 1 mm thick with a highly efficient system for the detection of internal defects in the medium term. Sheet thicknesses, such as those used in the automotive industry.

In this principle, the material is exposed to an external magnetic field that is measured directly above the material surface. A change in the cross-section or magnetic properties of the material changes its magnetic resistance and causes the magnetic field to escape from

the material surface. This method is already used in the form of magnetic particle testing, but only small parts of the manufactured strip can be tested offline with it. In addition, this procedure is time-consuming and limited to the testing of individual selected samples.

The leakage flux is measured with highly sensitive GMR sensors. At the same time, these enable a high resolution in transverse direction with a distance to the strip of at least 0.5 mm. Forty-eight GMR sensors are combined in a sensor block and encapsulated for protection.

The magnetisation transverse to the strip direction achieves a maximum signal-to-noise ratio (SNR) for elongated defects as they typically occur in rolled steel. By using electromagnets, the magnetic field strength can be adapted to the thickness of the material. They are switched off for cleaning or maintenance.

The magnet, the GMR sensor block as well as the amplifiers and digitalisation are combined in a compact sensor module. Every sensor module measures a range of 48 mm. By arranging the sensor modules in two rows, the strip can be detected seamlessly. The sensor modules are measured precisely in IMS's factory and can therefore be exchanged with a quick-change device without further alignment.

Eight modules are combined and work as magnetic line scan cameras. The image data is transferred to the image processing computer via a standard GigE interface.

State-of-the-art image processing software classifies and visualises the internal defects found in a very impressive way.

The measurement is performed on a non-magnetic roller. The sensor modules are arranged in two rows and can be positioned exactly at the required distance. An upstream wrinkle detector reports major unevenness in the material to be measured, such as wrinkles, at an early stage so that the measuring frame can be lifted for the moment this point passes. This reliably prevents damage to the sensors.

The use of an IDS can therefore prevent delivery of defective material and ensure perfect product quality for the end customer. Further, the measurement results can be used to optimise the pre-material stages and thus increase output.