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- Accredited laboratory in line with DIN EN ISO / IEC 17025, to qualify and validate new non-destructive testing (NDT) processes for industrial applications
- Accelerated time-to-market and opportunity for qualified, norm-compliant deployment in industrial applications as well as for complete new in-house developments or custom adaptation of innovative NDT technologies, even in fields where norms have not been established
- Certification of the corresponding quality management system in accordance with DIN EN ISO 9001



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PROGRAMME INTER CARNOT FRAUNHOFER

MAGNUS

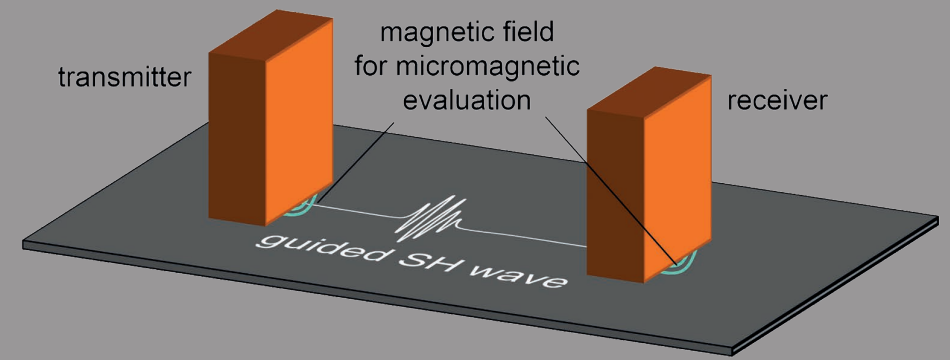
**HYBRID MICROMAGNETIC ULTRASONIC TESTING SYSTEM FOR
IN-LINE INSPECTION OF ADVANCED HIGH-STRENGTH STEEL**



AHSS stripe steel
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MAGNUS with holder



Principle of micromagnetics / ultrasonics combination

Situation

Advanced high strength steels (AHSS) are used in the automotive industry for car body constructions in order to reduce vehicle weight (and therefore the CO₂ equivalents) while maintaining or even improving safety and reliability of the construction. However, the beneficial properties of AHSS are much more sensitive to process variations than those of regular steel, raising the need for improved process monitoring and quality control. The same applies to other advanced steel qualities. So far, there is no comprehensive inline testing solution accounting for all parameters of interest. For example, texture and grain size are still measured in the laboratory at randomly taken samples.

In MAGNUS, the consortium of Fraunhofer IZFP and CETIM aims at the development, evaluation and standardization of a robust high-speed hybrid multi-probe testing system based on a smart sensor principle. It combines micromagnetic and ultrasonic methods, joining their complementary information for an optimal in-line steel strip materials characterization in a real-life harsh environment.



Our innovation: A smart sensor combining micromagnetic and ultrasonic methods

In the framework of MAGNUS, equipment will be developed which makes the combined methods available to a wide field of customers. The main application will be in strip steel industries, but the affordable multiple-probe support and high speed of the system to be developed will also serve other industrial branches such as heavy plate production and producers of components with recurring geometric features (camshafts, crankshafts, gears, bearings). MAGNUS zeroes in on:

- A method for the contactless, process-integrated and fast (real-time) determination of the most essential quality parameters of regular steel and AHSS: yield strength, tensile strength, texture, grain size and secondary phase content in addition to flaw detection.
- A smart and rugged “hybrid probe” which uses synergies between its internal components in order to operate as both electromagnetic acoustic transducer (EMAT) and micromagnetic sensor (ie. not just combining EMATs and micromagnetic probes, which leads to high costs).

- A cost-efficient solution for connecting and synchronizing multiple “hybrid probes” to the measuring system in order to measure the distribution of the properties across the width of the strip (rather than just at one position as in the state of the art).
- A method of maintaining an air gap and a procedure / an algorithm of lift-off in fluence compensation in order not to touch the strip and still obtain reliable results.
- Measuring speed increased by approximately one order of magnitude as compared to the state of the art, allowing for sufficient surface coverage at high strip speeds and with multiple probes.
- A combination of technical improvements and software tools which ensure the fast return to normal operation in case of a probe or device replacement which currently required a time-consuming recalibration.

Benefits

- Destructive tests on random samples can be replaced by nondestructive in-line testing with high surface coverage of yield and tensile strength, texture, grain size and secondary phase content, making process and products safer, greener and less expensive.
- Measuring accuracy and speed, robustness of the approach and surface coverage are higher than those of existing systems – at affordable costs.
- Strong efforts towards standardization of the method will be started and strategically pursued for the benefit of the full value chain of the steel production.
- Well-documented in its characteristics and suited for all kinds of strip steel including AHSS.
- Guidelines will be created and a transnational workgroup will be initiated to take care of applications and further developments for the synergy of EMAT and micromagnetics in other fields of application.

MAGNUS interlinks Fraunhofer IZFP’s scientific, methodical and technological expertise in the field of electromagnetic NDT with Carnot CETIM’s industry orientation and the corresponding knowledge about transferring, using and evaluating NDT systems in the industrial environment. The combination of scientific-technical excellence and the tailored application with respect to industrial needs ensures the creation of tailor-made innovation.

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