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Advanced Coating Thickness Measurement in Electrical Steel Manufacturing with EMG SOLID® DFT

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Electrical steel is an essential pre-product for efficient electrical devices. In cold rolling processes, an iron-silicon alloy is rolled into thin electrical strips (typical thickness 0.5 mm), which are then annealed and coated with special insulating varnishes. Sheets of different shapes and sizes are then punched and assembled to form magnetic cores. The thickness and homogeneity of the insulating varnish play a special role. Its main functions are insulation, corrosion protection and extension of the life cycle of punching tools.

Traditional measurement methods, such as beta backscattering (BBS), face increasing limitations due to the restricted availability of radioactive isotopes. Infrared (IR) techniques, while viable, struggle with thin layers and surface roughness sensitivity. To address these challenges, EMG has developed the EMG SOLID® DFT system, leveraging laser-induced fluorescence (LIF) to enable high-precision, real-time, inline thickness measurement of insulating layers.

LIF technology offers several advantages, especially high sensitivity, and reduced dependence on surface roughness. The EMG SOLID® DFT system operates by exciting coating molecules with UV laser pulses, detecting fluorescence emission, and correlating it with layer thickness. It is adaptable to various insulation classes (C3–C6) and works at strip temperatures ranging from 50 °C to 150 °C.

Laboratory studies and industrial trials have demonstrated that LIF-based measurements correlate strongly with BBS reference methods, while significantly outperforming BBS and IR sensors in accuracy and resolution. Inline tests in production revealed that even slight variations in coating thickness (as small as 0.1 µm) are clearly detectable, ensuring improved process control and product quality. Additionally, early detection of coating inconsistencies near the drying furnace minimizes material waste and production defects.

With its high-resolution, real-time monitoring capabilities, EMG SOLID® DFT establishes a new industry standard for the measurement of insulating varnish thickness on electrical steel, providing a sustainable and superior alternative to traditional measurement methods.

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