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Material thickness measurement

Non-destructive and on / of all material

There are basically 3 measuring methods to perform non-destructive thickness measurements on frame and body panels and paint thickness measurements on car bodies:

- *The magnetic-inductive measuring method for measurements on ferritic substrates such as sheet metal.*
- *The eddy current method for measurements on non-ferrous substrates such as aluminum*
- *And ultrasonic for substrate-independent measurements, or multi-layer measurements.*

Magnetic-inductive

The magnetic-inductive method is based on the change of a lo w-frequency field of a probe by approaching a ferromagnetic base material.

An electromagnetic field with low frequency is generated in the measuring probe by an excitation current. Field with low frequency (typically approx. 40 - 250 Hz), the strength of which is depends on the distance between the measuring probe and the base material. The magnetic field is detected by means of a measuring coil.

(The electrical inductance of a coil changes when an iron core is inserted into the coil, or when the coil is placed on an object made of iron, e.g. a plate. Therefore, electrical inductance can be used as a measure of film thickness when the coil is placed on a coated magnetizable substrate (base material).

Magnetic induction probes for thickness measurement of coatings on magnetizable material consist in most cases of two coils, the first (primary coil) for generating a low - frequency a lo w-fr equenc y alternating magnetic field and the second (secondary coil) to measure the resulting induced voltage "U" tobe measured.

lf the probe is placed on a coated magnetizable material, it varies as a function of the

the magnetic flux density and thus the induced voltage in the secondary coil varies as a function of the coating thi ckness . The function between the induced voltage and the coating thickness is nonlinear and depends on the permeability of the base material.

Eddy current method

An electromagnetic alternating field with a high frequency (typically approx.
frequency (typically appro x. 0.1- 20 MHz) is generated and induced in the electrically conductive substrate. The eddy currents that are generated in the substrate inhibit the
the alternating field depending on the distance to the probe.
lf a copper coil, usually applied to a core with negligible
electrical conductivity (ferrite or gemstone) and low magnetic resistance, by a high-frequency current by a good conductor such as a no n-ferro meta1, eddy currents are generated in the conductor according to the law of induction.
According to Lenz's rule, the magnetic field generated by the eddy currents is superimposed on the original field and the original field and weakens it. Thus the impedance change, which depends on the distance of the probe from the base material, serves as a measurement variable for the coating thickness.

Ultrasonic

However, there are 2 disadvantages with the two electromagnetic measurin g methods - on the one hand, only the total layer thickness can be measured and not individual layers, and on the other hand, a metallic substrate is required.
With the ultrasonic met hod, one is independent in both cases! Layer thicknesses can also be measured on different substrates such as metals, plast ics , wood or even GFRP or CFRP!
Furthermore, not only the total thickness, also the individual layer t hicknesses can be measu red, in only one measuring process - which is an enormous advantage compared to the electromagnetic methods !
Ultrasonic coating thickness measurement is a ru n-time measurement. An ultrasonic pulse is generated in the sensor and int roduced into the coating system. At th e respective boundary layers and at the su bst rate, parts of this ultrasonic pulse are reflected bac k and the time requir ed for this is rr1easured. Based on the time and speed of sound it calculates the resulting thickness of the layer. cnlates the resulting layer thickness.