Utilization of Eddy Current Tomography for Testing Ferrite Rings

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Paper presents results of an investigation of cylindrical ferrite samples on eddy current tomography setup. Non-destructive testing (NDT) with the usage of eddy current phenomena is well-known technique of production fault selection. Reference objects (validated with other measurement method) are measured and their signature response is obtained. Then tested objects are measured and their response is compared with reference objects response. Thus selection of the defective objects can be made. On the other hand it does not allow to determine the shape of the objects' defect and is not suitable for correction of production process. This gap can be supplemented with the usage of eddy-current tomography. This method merges the well-known advantages of eddy current testing with the possibility of determination of defects' shape, size and location.

During the measurement process tested object is placed between two coaxial coils – exciting and measuring. The exciting coil is supplied with an alternating sine current, which generates alternating magnetic field. This field induces eddy currents in the tested object, which influence the magnetic field measured by the second coil. Depending on the objects' shape, the distribution of the eddy currents may significantly vary. On the other hand the measurement coil response is an implicit function of the defects' size, shape and orientation as well as from the physical parameters of the tested sample, mostly its magnetic permeability and electrical conductivity. Thus the data from the single measurement is not suitable for the objects shape reconstruction. The measurement process is based on measuring the amplitude of the inducted signal as well as the phase shift between the exciting and measured signal. The measured object is moved linearly (perpendicularly to the coils' axes) and in each linear step is rotated around its axis. The tomography setup is most suitable for axisymmetric samples so for the tests typical ferrite ring with high magnetic permeability and low electric conductivity was selected.

The measurements were conducted on the ferrite ring in a fabric state and with series of reference defects. Results confirmed the possibility of utilization of eddy current tomography for the determination of defects' shape and size. Further work shall concern development of inverse tomography transformation which may allow not only determine the size of objects' defects but also its physical properties such as magnetic permeability and electrical conductivity.