APPLICATION NOTES

FOERSTER

Detection of magnetic impurities for quality monitoring of bearings

Industry:	*Bearings manufacturing and related application areas*
Material/Part type:	*Bearing*
Measuring parameter:	*Magnetic remanence*
FOERSTER device:	*MAGNETOSCOP with Hall probe*

Residual magnetism (i.e. magnetic remanence) present in the raw material from which bearings are made can often be very undesirable for their subsequent industrial use. Adhesion of metallic particles to magnetic remanence hotspots can cause not only deficiencies in the component itself but also damage that can lead to the outage of a complete facility/equipment, where this bearing is placed. Therefore, identifying and testing of magnetic remanence, both before and after demagnetization, is indispensable for quality control.

There are two reasons why magnetic remanence appears in components such as bearings or hydraulic parts, gears etc.: either they are produced entirely from a magnetizable ma-terial that can change its magnetic condition (Type A), or their non-magnetizable parts are attached by magnetic (or magnetizable) impurities in the process of transportation or production (Type B). In both situations, the field strength of the residual magnetism can strongly vary, depending on the material and manufacturing process used. Just a few millitesla can cause a significant adhesion of metallic particles, quickly leading to abrasion or failure of the bearing component. To address this problem, standards set by the German Association of the Automotive Industry (VDA), for example, recommend a limit of 0.25 mT for the magnetic field signatures, as this is considered non-critical for any components that come into contact with the medium (oil).

To minimize the magnetic remanence, either the raw materials or the final components are demagnetized. However, this approach does not permanently solve the problem but only postpones its manifestation, shifting it to the final product level. Despite demagnetization, Type A components can re-magnetize during transportation, storage or machining. And ferromagnetic impurities can adhere to non-magnetizable (Type B) components in the process of transportation or mechanical machining, meaning that even initially non-magnetic material suddenly displays magnetic remanences. Furthermore, defects such as cracks and deformations in the finished part can cause magnetic remanences regardless of material type.

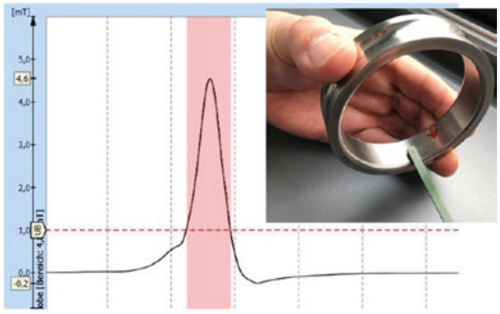

Figure 1: Typical signal of remanence detected at crack's spot

Given that the magnetic condition of components can fluctuate at different points along the product value chain, statements provided by suppliers or third-party measuring labs do not suffice: For reliable quality control, there is no substitute for in-house measuring equipment and procedures. A simple and cost-effective approach is to scan the components with Hall sensors at various production stages. But the commonly available Hall sensors were developed for use with permanent magnets; their resolution (e.g. 100 μT) is not sensitive enough for the above-described magnetic remanence testing. For this purpose, FOERSTER has developed a series of Hall sensors based on its MAGNETOSCOP device with a measuring range from 1 μT to 50 mT. Transversal or axial probes – depending on sample shape – enable temperature-compensated detection of localized remanences with high precision.

For testing of magnetic remanences on bearings we recommend FOERSTER's MAGNETOSCOP with transversal and axial Hall probes. For further information please visit our website: fluxgate-magnetometer.com