

Statistical evaluation of the Barkhausen Noise Testing (BNT) for ground samples

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The Barkhausen Noise Testing (BNT) is a non-destructive method for investigation many of ferromagnetic material features. The most common application is monitoring of so-called grinding burns caused by introducing locally high temperature while grinding. Other features, such as microstructure, residual stress changes, hardening depth, etc., can be monitored as well. Nevertheless, because the BNT is a method based on a complex magneto-electric phenomenon which still needs more scientific investigations an understanding, it is not standardized yet. Therefore, there is a need for studying of traceability and stability of the measurement method. The aim of this study was to carry out statistical analysis of the ferromagnetic samples after grinding processes by the use of BNT. The first part of the experiment was to grind samples in different facilities (Sweden and Finland) with similar grinding parameters, different grinding wheels, and different hardness. The second part was to evaluate measured BNT parameters in order to determine significant factors affecting BNT signal value.

The measurement data from the samples were divided into two different batches according where they were manufactured. Both grinding batches contained measurement data from three different appraisers. The main feature for calculation was the RMS value from the Microscan direct results. The first processing step was to normalize the RMS values for all the measurements. The standard analysis of variance (ANOVA) was applied for the normalized dataset. The ANOVA analysis showed that a significant impact on the BNT signal value has grinding parameters, while the other investigated factors (e.g. measurer) are negligible. The reasons of that are discussed at the end of the paper.