Verifying of the concept Sum of Effective Residual Stresses (SERS) as the index of part quality evaluation during manufacturing process

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For a part control in the production, it is necessary to use methods that do not harm the product in any way. This is very complicated in many cases. The most suitable non-destructive methods are micro-magnetic analyzes or X-ray diffraction measurements. The advantages of magnetic methods are their speed and depth of penetration and the resulting size of the analyzed area, as well as their high sensitivity to structure and residual stress.

Nowadays, quite a spread detection method is Barkhausen noise analyzes that provides quick and reliable control. Its disadvantage is that from the output of the measurement it is not easily possible to determine residual stresses directly and the measured data must be compared with the reference sample.

This disadvantage is parthly leveled by measuring the residual stress with well know method of X-ray diffraction, which allows the residual stress to be measured directly, but destructively by the way of depth profile etching and at much longer time. Indirectly, these methods can be used for comparison and refinement grinding process.

One way for comparing methods could be a concept of the Sum of Effective Residual Stresses (SERS) which is based on the different absorption depths of the measurement methods used, such as X-ray diffraction and Barkhausen noise.

This sensing depth is closely related to the size of the analyzed area, varying with depth below the surface of the material. An important point is therefore to cover the whole area where negative effects can occur. Most often it´s machined layers, where the residual stress moves in tensile values. Tensile residual stress negatively contributes to the fatigue of particular parts in difficult conditions such as bearings or gears. With this consideration is SERS proposed to use as the critical parameters for the evaluation of magnetoelstic parameter threshold value in production quality control. Whereas verifying this concept for a varios steel material with different type of manufacture processes is necesery, we do analyzes on bearing steel 100Cr6, carburized steel and tool steel.

Results are promising and shows possible threshold value SERS of 0 kJ/m^2 as the index of good part quality without tensile residual stresses.

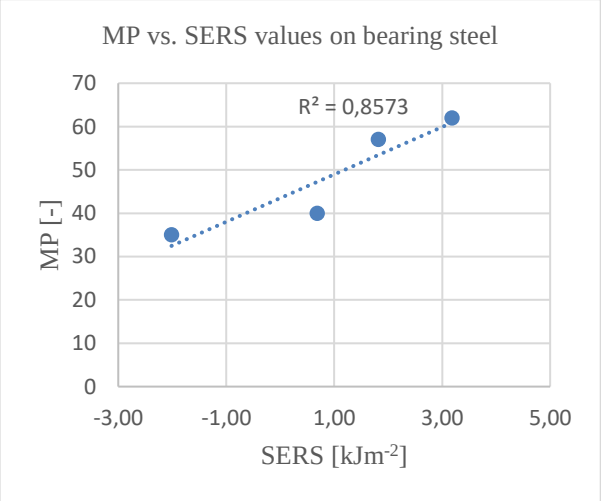

Figure 1 Dependency of mp vs. SERS on the bearing steel