Grinding burn is a problem of high technical and economical importance. It is known from the production of roller bearings as well as gears. Grinding burn is a consequence of elevated temperatures caused by grinding which can occur due to insufficient cooling, unsuitable cutting / grinding parameters, or high material removal rates. This thermal influence can anneal the hardened steel surfaces causing a reduction of materials properties. Moreover, tensile residual stresses can be created in the affected surface layers. All these factors together can lead to the well known gray stains at ground surfaces of heavy duty components as well as pitting and fatigue cracks. As such, the lifetime of the components can be drastically reduced by grinding burn. Especially, in high rate production of gears and bearings for automotive applications as well as in the production of large heavy duty gears and bearings for power generation, grinding burn can cause significant economic loss.

In this paper, different degrees of thermal influence and the different appearances of thermal damage due to grinding are analyzed and illustrated by examples. X-ray residual stress determinations show the thermal influence due to grinding on the macro and micro residual stress states. The results are correlated with metallographical investigations and micro hardness measurements. It is shown that the thermal influence due to grinding is best characterized by describing the changes of macro and micro residual stresses. Both types of residual stresses must be considered as examining only one residual stress type can lead to erroneous conclusions.

The possibility of non-destructive fast characterization of ground surfaces by magnetic or eddy current methods is also shown. Such qualitative measurement techniques have to be calibrated. Based on the above-mentioned considerations of macro and micro residual stress changes due to thermal influences during grinding, calibration bodies are suggested with defined thermal modifications by laser treatments.