PROCEDURES FOR NONDESTRUCTIVE RS-MEASUREMENTS OF INNER SURFACES OF BALL BEARING COMPONENTS

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Thin walled ball bearing rings are sensitive to geometry and shape distortions caused by the sum of manufacturing processes. In the past only one single or a few X-Ray diffraction measurements on the outer circumference were considered as representative for the complete part. Local differences at surfaces or across different cross sections as well as residual stress states on the inner surface often have been neglected due to insufficient measurement time, geometrical constraints and therefore high costs. In an ongoing research program, residual stress states in ball bearing rings have been identified as pronounced distortion potentials. A rough estimate for the determination of residual stress states after all steps of a manufacturing process of rings with diameters >100mm will easily lead to a hundred of measurements. These components in the sequence of manufacturing operations are not allowed to be cut for residual stress measurements. Therefore, more than one method has to be applied for the measurement of outer and inner circumference. As state of the art residual stresses are determined by X-Ray diffraction techniques. The use of micromagnetic methods is promising due to easier accessibility on inner surfaces and to the measurement time required. However any analysis by micromagnetic methods has to be calibrated by X-Ray diffraction measurements. In this paper a procedure for nondestructive RS measurements on inner surfaces of cylindrical and tapered ball bearing is presented. As one example for the any manufacturing process the analysis of machining induced residual stresses has been investigated. 36 measurements in axial and tangential direction on the outer and inner surface of these rings with X-ray diffraction and micromagnetic methods form the database. The effect of different machining parameters was demonstrated. A combination of X-ray diffraction and micromagnetic measurement methods seem to be an interesting solution for a reliable characterization of components with an important gain of time compared to the use of X-ray diffraction analysis only.