

Residual Stress Distribution in Sinters of DistaloyAE and DistaloyHP

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Abstract

Purpose of this paper is to elaborate X-ray diffraction methodology for to characterize two PM steels: DistaloyAE and DistaloyHP from Höganäs AB, Sweden. The beneficial feature of diffraction methods is the non-destructive character and large amount of structural information contained in the diffraction pattern.

Design/methodology/approach. The qualitative and quantity phase analysis, classical $\sin^2\psi$ and modified $g\text{-}\sin^2\psi$ [1] methods were used to residual stresses measurement (σ_1). The profile diffraction line analysis (PDLA) was used to quantify the lattice distortion $\langle\varepsilon\rangle$ and to evaluate the average crystalline size. All methods were elaborated for both i.e. classical Bragg-Brentano (BB) and grazing incidence angle X-ray diffraction (GID) geometry. In the case of last one, the mentioned above properties can be scanned versus depth under surface in non – destructive way.

The results obtained for the sintered samples indicate that diffusion grain-growth takes place during sintering. The gradients of elements concentration versus grain cross-section and the irregular space distribution of austenite make this alloy an composite with gradient-like microstructure. This gradient-like structure is confirmed here by residual macroscopic stresses measurement, quantitative X-ray diffraction phase analysis, micro-stresses and texture factor.

The ability of X-ray diffraction methods based on GID geometry to scan structural properties layer by layer is promising to this type of composite-like materials. The results from GID geometry measurements confirm non-uniformity of structural, phase composition and some properties as well. The method can be used to characterize structural properties of thin surface layer versus thickness in non-destructive way.

Practical implications. The results have put emphasis on the importance of the surface state of PM steel. The detailed information about distribution of alloying elements as revealed by the residual stresses and amount of retained austenite form a solid base for further development of PM steel for high loaded applications.

[1] S.J.Skrzypek, A. Baczmański: Progress in X-ray Diffraction of Residual Macro-stresses Determination Related to Surface Layer Gradients and Anisotropy, *Advances in X-Ray Analysis*, 44, (2001), 134-145