RESIDUAL STRESS MEASUREMENTS BY X-RAY DIFFRACTION: CRITICAL EVALUATION OF ERROR SOURCES.

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X-ray diffraction measurements of residual stresses in crystalline samples require a precise determination of *d*-spacings of a particular set of crystallographic planes as a function of orientation of this set with respect to the sample surface. Differences in experimental settings, like the state of sample surface, instrumental and sample alignment, as well as different approaches to the data processing may affect the obtained values of residual stresses. Therefore, characterization of the influence of these factors on the result of residual stress measurements is essential for reproducible and reliable evaluation of residual stresses in materials by the X-ray diffraction method. With the objective of studying the influence of different factors on the result of residual stress measurements with modern computer controlled diffractometers a set of carbon steel samples SAI 1070 was prepared. Sand blasted surfaces ensure similar values of surface residual stresses and residual stress depth profiles. The surface residual stresses states were measured in different diffractometers at IWT (Germany) and Inmetro (Brazil) using Ψ geometry. The results of measurements are compared for different conditions of diffraction measurements and instrumental alignment, and included the variation of 2Θ step size, 2Θ range, counting time, number of Ψ tilts, sample positioning, a sample area probed by X-ray beam, centre of diffractometer with respect to X-ray beam path. Different approaches to the data processing including the evaluations of different background subtraction methods and evaluation of influence of instrumental function on the position of measured Bragg reflections are presented.