Static and Dynamic In-situ-computed-tomography for Dimensional Metrology Applications

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In order to examine material characteristics and the performance of testing parts from that material, which are connected with a certain technique (i.e. welded, glued, crimped, riveted, screwed) compression-tension facilities (CTF) are generally in use. A new compact CTF was developed, which can be easily placed on the rotation plate of common CT-Systems. 3D-Scans are performed without loss of image-quality due to the special shape of the CTF. This system enables new insight, because material behavior can be observed three dimensionally, while the testing part is under load. Especially the connection area and the characteristic inside the material can be investigated. Furthermore scanning under load is not limited to idealized test parts, it is also possible to investigate real industrial manufactured parts and check for example their geometric behavior under load. This geometric change can be measured nondestructively on the micrometer scale. In addition to the static case, where a constant force acts on the specimen, the CTF provides also a dynamic variable force in order to execute endurance and fatigue tests. The poster presents studies and results of test scans performed with the CTF.

The facility for static measurements consists of a stable cylindric PMMA housing, which can be easily penetrated by X-Rays from all directions and therefore allows artefact-free reconstruction of 3D-CT-Scans. Forces with maximum 15kN can be realized.

Nevertheless, results from static measurements only reveal first impressions of the material characteristics and the behavior of the testing parts in the field. Therefore a facility where variable forces can be adjusted has been developed. It is possible to apply custom-designed load curves (i.e. Wöhler fatigue test DIN 50100, random load, fatigue strength tests). After a certain fatigue test, a scan under a special constant force is applied.