Development of a new methodology of Roughness Measurement using Optical Coherence Tomography (OCT) according DIN 4768

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The measurement of surface roughness is very important in several applications, but for soft or delicate samples like some kinds of ceramics, textile products, papers or biological tissue the traditional technique, that uses physical contact components, can cause an erroneous roughness parameter measure and the equipment can also perform serious damages to the sample. Optical Coherence Tomography (OCT) is a technique that uses a Michelson Interferometer to provide a cross section image of the sample with noninvasive and no contact parts, turning the OCT technique a ideal methodology to image soft samples and determine the surface roughness. DIN 4768 standards establishes the method to characterize the surface roughness according to two defined parameters, Ra and Rz. Ra is the arithmetic mean of the absolute amounts of all variances in the roughness profile from the centre line over the total distance. Rz is the arithmetic mean of the distance between global maximum and minimum in five successive subsections of a single sample. Roughness standards with Ra nominal values of 0.8, 1.6, 3.2, 6.3, 12.5, 25.0 and $50.0\mu m$ was image using a commercial type OCT (Thorlabs Inc.) with $6\mu m$ axial resolution (in air) and $6\mu m$ lateral resolution. A homemade software was developed, in LabVIEW environment using image processing, to analyze the acquired images and provide Ra and Rz parameters value, that were compared with the nominal values, in order to check the precision an reproducible of this methodology.