Analysis and Characterization of Machined Surfaces with Aesthetic Functionality

The generation of fine machined surfaces with high gloss is an important topic in mould manufacturing. The surface gloss can be characterized by means of scattered light sensors and a representative parameter such as $A_q$. In this paper, in-line measurements of scattered light distribution are compared with roughness parameters calculated using a confocal microscope, in order to assess surface aesthetic quality. Several surfaces have been machined by means of high precision milling, producing different surface topographies. Surface characterization has been performed on a machine using a scattered light sensor, and using a confocal microscope in laboratory conditions. The calculated $A_q$ parameter is compared with the amplitude roughness parameters $S_a$ and $S_q$, and with hybrid parameters $S_{dq}$ and $R_{dq}$ representing the average slope of the surface features. Scanning electron microscope (SEM) images are used as visual benchmarks to identify the parameters’ correlation with the visual appearance. A different linear trend of the relationship between $A_q$, $R_{dq}$, and $S_{dq}$ is observed. The description of the surface quality through $S_a$ or $S_q$ instead is found to be insufficient. This is explained by means of SEM pictures showing a dramatic influence of the smeared material over the machined surface.

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