

Surface Analysis Study of Laser Marking of Aluminum

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Abstract

Nowadays, traceability combined with robust and permanent identification of industrial parts is becoming a crucial element of the manufacturing processes. Laser marking of metal parts is a technology showing many advantages compared to labelling, inkjet or dot peen marking. Advantages include no consumables, faster cycle time, reliability and repeatability of the process and robustness of the marks. In this paper, we aim to study the physics involved behind the process of laser marking on aluminum. The marking is generally made in black surrounded by a white background applied to increase contrast. We show the results of a surface study for both surface whitening and blackening performed with a Dektak surface profiler and a scanning electron microscope (SEM). A physical explanation of the whitening and blackening of the aluminum is provided - based on these results. Different characteristics of the surface are also discussed with regards to the laser parameters. The results explain why a blackened and a whitened surface do not scatter light the same way. The whitening is produced by the surface texture of small amplitude which creates a diffuse reflection. The blackening is produced by a surface texture of greater amplitude that increases the coupling of the light within the material.

Keywords: Laser marking; parts traceability; barcode; datamatrix; serial number.