Influence of Laser Cutting On Structural Changes in Metals

Libuše Sýkorová, Milan Žaludek, Milena Kubišová, Vladimír Pata, and Jana Knedlová

Tomas Bata University in Zlín, Faculty of Technology,, Department of Production Engineering, Vavrečkova 275, Zlín, 760 01, Česko

The current level of engineering production requires that applied materials meet the most demanding criteria, whether in terms of longevity, wear or economic. We have to deal with the high demands on the processing of these materials by the application of unconventional technologies, as conventional machining methods often no longer meet the requirements for speed and quality of processing. Laser technology is undoubtedly at the forefront of these technologies. However, one of the drawbacks of the laser is the thermal impact of the workpiece due to the concentrated energy of the radiation and the resulting structural changes in the material, which may affect the physical properties of the material and, consequently, the product. The present paper deals with the issue of laser machining of metallic materials with a focus on the possibility of formation and assessment of structural changes as a result of the absorption of thermal radiation. Due to the thermal conductivity of the metals, the high temperature at the cutting point extends further into the material. The highest temperature is reached by the area closest to the cutting joint, which is why subsequent cooling leads to the most significant changes, with the possible formation of a martensitic, bainitic or pearlitic structure just in the vicinity of the cutting edge.

For a detailed assessment of the heat-affected zone, experimental machining of selected technical materials was carried out and, based on hardness measurements; this area was further statistically evaluated. The published article addresses the fundamental problem of whether similarity can be found between different types of laser-machined materials.

[1] Maňková, I. Progresívné technologie, Vienala Košice, ISBN 80-7099-430-4. (2000).

[2] R. Radovanovič, Mathematical Model for Severance Energy by CO2 Laser Cutting of Mild Steel Strojírenská technologie, IX, p. 3, (2004) ISSN 1211-4162

[3] V. Pata, L. Sýkorová, O. Šuba, M. Malachová, Simulation of the transient temperature field when laser machining polymeric materials, Key engineering materials. 2016, (686), 246 - 251. ISSN -13: 978-3-

[4] O. Bílek., I. Lukovics, Determination of the Residual Stress through the Thickness of Plastics and Metallic. Manufacturing Technology, vol VI, p.12-16, ISSN 1213248-9.

[5] Jurko, J. Influence of laser cutting speed to the surface quality. Functional surfaces, GC TECH Trencin, p. 68-71, (2002). ISBN 808891471.