

Title:

FORMATION OF THE STRUCTURE AND PROPERTIES OF THE SURFACE LAYER OF ALLOY STEELS USED FOR TOOLS BY THE LASER TREATMENT

By:

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Abstract:

The functional properties of many products and their parts depend not only on the capability to transmit mechanical loads through the entire active section of a part made of the material applied, which is often heat treated, or on its physiochemical properties, but often also, or mainly, on the structure and properties of surface layers. In such cases, economic considerations necessitate the use of surface layers ensuring the required functional properties, using possibly cheap materials for the core of the part, as generally different usable properties are required from such core. The properties of the core and of the surface layer of the part produced can be customised most advantageously by selecting appropriately the part material and by selecting the processes forming the part structure and properties, and by selecting the surface layer type and technologies which ensure the desired functional properties. The laser surface treatment of diverse materials is one of the methods enabling to fabricate a surface layer with its thickness of decimals of millimetres to several millimetres and with enhanced functional properties, high hardness and wear resistance, while retaining the properties of the substrate. Laser Surface Alloying (LSA) is one of the most modern surface treatment processes in which surface layers of materials are enriched with alloy additives and their structure is changed. High power densities enable the precise heating and controlled cooling of a small volume of material at the rate of over 10^8 K/s and at a solidification rate of even over 20 m/s, permitting even to manufacture layers having an amorphous structure approx. 20 μm thick. The structure and chemical composition of a surface layer manufactured in a laser alloying process, as well as its physical properties, differ largely, both, from the virgin material and the alloying material. A laser alloying process permits to manufacture surface layers with small thickness, special properties, with high wear, erosion and corrosion resistance, with high resistance to aggressive chemicals, possessing high hardness and with high fatigue strength and high heat resistance.