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Composite surface layers in the system of metal matrix - interstitial phase, laser cladded on low-carbon structural steels

Abstract

The work presents the research results of potential and operating properties of the composite surface layers in the system of metal matrix (Stellite-6) – reinforcing phase (boron, silicon and tungsten carbides) produced on structural steels by laser cladding method. The surface layer characterized by the best properties was applied to increase durability of agricultural tools used in the soil.

In Chapters from 1 to 3 were presented the literature state about the issues of agricultural tools used in the soil, as well as the available ways to increase their durability. Construction and operation of the lasers and their use possibilities in produce of surface layers were described. Current state of knowledge about composite surface layers of reinforced with particles of boron, silicon and tungsten carbide were discussed.

In Chapter 4, on the basis of literature analysis and own experience, the aim of work was defined and thesis was formulated. The aim of study of produced surface layers was to determine their mechanical and physico-chemical properties, as well as potential possibilities of applications with particular regard to agricultural applications in the form of soil cultivation tools.

In Chapter 5 the manufacturing technology of composite surface layers was presented and also the research methodology was proposed.

Chapter 6 was divided into two parts. In the first part, the preliminary study results, involving preparation of the surface layers reinforced by phase in the form of boron and silicon carbide particles were discussed. In the second part the Stellite-6/WC composite surface layers were described. The results of macroscopic and microscopic study were discussed in further detail and based on them, the amount of carbides in the surface layers was estimated. Results of physicochemical study (EDS, XRD, corrosion tests), microhardness measurements as well as wear resistance both in laboratory and in operational conditions were analyzed.

In Chapter 7, within the summary, the model of formation the precipitates on the border of matrix and reinforcing phase particles was presented. A comparison between the sintered material, and selected variant of composite surface layer was also presented.

At the end of the dissertation, conclusions from cognitive and utilitarian studies were presented.

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