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EVALUATION OF RELIABILITY OF INJURY IN THE FINISH FORMULATION OF OPTICAL SURFACES OF BOROSILICATE GLASS WITH SEMICONDUCTOR CDS NANOCRYSTALS AT THE EXECUTION OF THE MACHINING PROCESSES

In order to improve the quality and reduce the cost of production in the modern machine-building industry, mechanical processing technologies are constantly improving. On the other hand, interest in obtaining new promising materials with the desired physical and mechanical properties is due to both fundamental and applied aspects. By methods of optical spectroscopy, a certain range of results can be obtained that underlie the creation of materials for use as active elements for solar cells, memory cells, photocatalysts, optical and optoelectronic devices, and the like. Preparation for such studies requires the production of high-quality optical surfaces, thus, a special approach to the implementation of technological processes of machining, timeliness, finishing polishing operations. In turn, the search for new promising objects is based on the increasing use of non-metallic materials, the technology of mechanical processing of which constantly requires significant changes to obtain optical surfaces with high quality requirements. The study of the processes of manufacturing optical surfaces, by performing mechanical processing, as a result of the various mechanical properties of new materials, is a necessary and timely process. Separately, it should be noted that one of the promising nonmetallic materials that can be used as the basic active elements in the above-mentioned advanced devices and devices and what has become the focus of scientific attention are semiconductor CdS nanocrystals interspersed with a matrix of borosilicate glass [1]. Thus, the combination of these aspects make the conduct of the presented studies relevant and timely.

It is known that finishing machining significantly affects the cost of manufacturing optical surfaces made of borosilicate glass with semiconductor CdS nanocrystals, in connection with the probability of damage to the surface layer, which can lead not only to losses of boundary-tolerated dimensions of optical parts [2]. Typically, this occurs as a result of the negative impact of the ingress and wedging of the solid particles of the cutting products, and scratch the surface, significantly reducing the roughness.

The purpose of the research was the question of the possibility of evaluating the calculation of the probability of damage occurring at the final shaping of the optical surfaces of borosilicate glass with semiconductor CdS nanocrystals in the process of machining.

The question was examined on the investigation of the relationship between two basic altitude parameters of the surface roughness *Ra* and *Rmax* and on the features of the formation of active surfaces of borosilicate glass with semiconductor CdS nanocrystals using abrasive materials and a lubricating coolant [3].

It was found that scratches on optical surfaces occur due to the jamming of solid cutting products, bound coolant, between the surface to be treated and the tool.

To determine the probability of falling into the cutting zone of solid particles that damage the surface layer of optical components, they used the methods of probability theory [4, 5].

As a result of the work, a formula was derived for the probability that solid particles of cutting products would enter the finishing zone:

$$P_3 = \frac{1}{\sqrt{8\pi^3}\cdot\sigma\cdot\sigma_d}\int_0^{d_{\max}}\left\{\int_h^{h+\sigma}\frac{1}{d}\exp\left[-\frac{(\ln d - m)^2}{2\sigma^2}\right]dd\cdot\right.$$

$$\left.\cdot\int_{h-d}^{h}\left[\int_{-\frac{d_3}{\sigma_d}t+\frac{d_0}{\sigma_d}}^{\infty}\frac{1}{}\exp\left(-\frac{t^2}{2}\right)dt\cdot\int_{-\frac{\sigma_c}{d_0}\left(1+\frac{\sigma_d}{d_0}-\frac{x}{d_0}\right)}^{\frac{x}{\sigma_c}}\exp\left(-\frac{U^2}{2}\right)dU\quad dx\quad dh\right.\right.$$

where d – the maximum particle size of the solid particle;

m and σ – logarithmic normal distribution parameters,

h – the size of the solid sticking particle,

2σ – is the length of the particle size interval on which the scratching occurs.

Analysis of the formula shows that a solid particle, which has got together with the coolant into the cutting zone, leaves a scratch-scratch on the surface in the case when the dimensions of the part are equal or slightly higher than the distance between the surface of the part and the surface of the tool. The wedging of a solid particle of size h will occur if the particle diameter approaches the size of h from above, and the distance between the protruding vertices of the abrasive grains of the tool and the surface of the part is close to the size of h, approaching it from below.

Also, the analysis of the formula indicates that when grinding optical surfaces of borosilicate glass with semiconductor CdS nanocrystals, the parameter *Rmax* is affected by the particle size of the abrasive slurry, their amount in the coolant and the probability of wedging of particles in the contact zone. As these factors increase, the *Rmax* roughness parameter increases, which worsens the overall roughness of the treated surfaces and optical purity for the active surfaces of borosilicate glass elements with semiconductor CdS nanocrystals.

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