Laser-plasma structuring of glass surface with powder

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Introduction

There are many ways of laser surface structuring, as well as the causing of powder materials films using laser irradiation. This surface structuring is used in electronics ***[1]*** and mechanics ***[2, 3]*** in order to set the required material properties. Laser processing has a number of advantages over other types: manufacturability, ease of automation, relative safety, localization of action. Therefore, laser surface structuring is an important task of modern science. In this work we propose a new method of causing powder materials on the surface of the glass substrate using a specially designed method and device.

Methods

It should be noted that this method of causing allows to adjust the resulting structures, both by changing the type of topper transparent plate and its thickness, as well as changing the clamping force between two transparent plates, and not just adjusting the power of laser radiation ***(Fig. 1).***

As substrates for structuring were used disks of glass K8, treatment was carried out using powders of titanium and aluminium, which had the shape of squama and dimensions: length 0.14-0.7 mm, width - 0.042-0.14 mm. Irradiation was performed with neodymium laser in the Q-switched mode, laser spot diameter - 4 mm, energy in the pulse – 4-4.5 J, pulse duration – 50 ns.

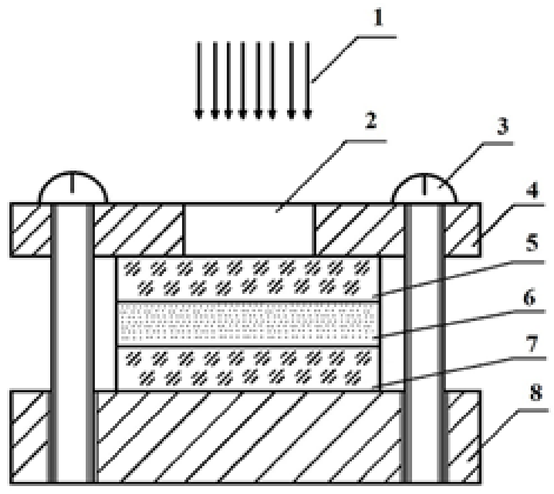
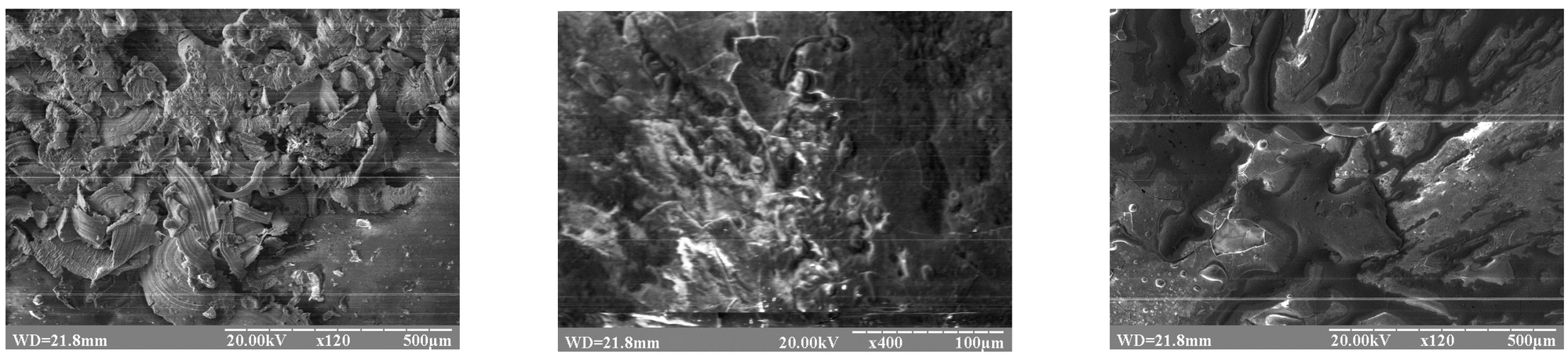


Fig. 1. *Scheme of the device for laser-plasma structuring of glass surface with powder*

Results

The performed scanning electron microscopy showed that the structure of melted and then frozen powder is formed on the surface. It should be noted that not all powder particles are completely melted, especially for titanium **(*Fig. 2, a*).** Also cracks can be seen on the surface of the substrate, which are caused by ultra-rapid expansion of the formed plasma **(*Fig. 2, b, c*).**



a ***b*** ***c***

Fig. 2. *Electron microscopic images of the glass surface after laser-plasma structuring with powder of titanium (**a, b**) and aluminium (**c**)*

Conclusion

This method showed the possibility of creating structures from powders on the surface of two glass plates (topper and bottom). The formed structures with titanium and aluminium powders have a good adhesion with the glass substrate. The proposed device allows to further adjust the type and quality of the obtained surface structures.

References

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