Synthesis of porous and oxide nanostructures by the method of laser irradiation using computer optics elements

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INTRODUCTION

The effect obtained by laser irradiation is determined to a great extent by the capability of the optical system to produce a pre-defined energy distribution over the treated material surface. The current variation of existing and developed optical systems demonstrates the importance of tackling this issue. In order to redistribute the laser intensity in the focal plane, which largely determines the course of structure formation processes in the treated materials, it is rational to use computer optics elements.

SYNTHESIS OF POROUS AND OXIDE NANOSTRUCTURES BY LASER EXPOSURE

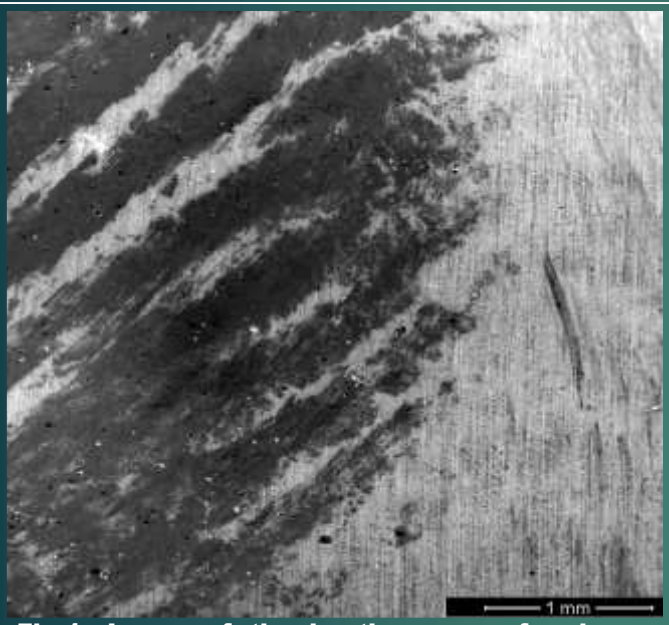

Fig.1. Image of the heating area of a brass sample with the formation of a whitish-grey film on the surface

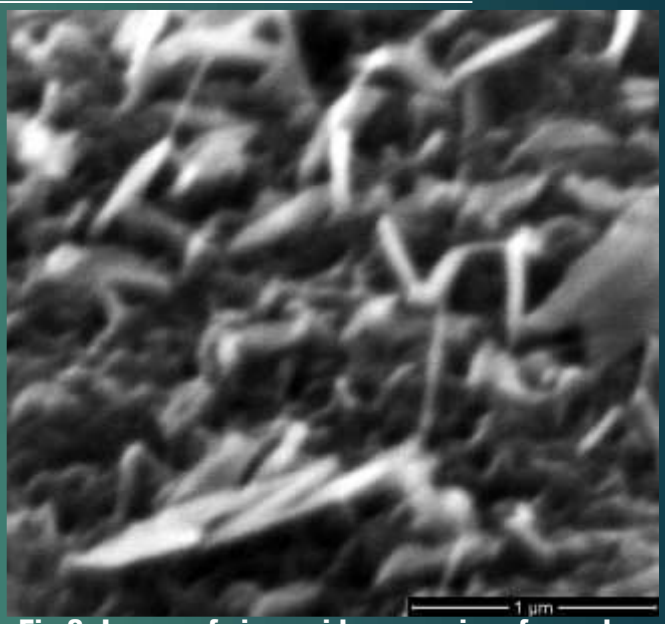

Fig.2. Image of zinc oxide nanowires formed on the surface of brass during pulsed-periodic laser irradiation

As a result of this synergy, a principally new method of creating nanostructured oxide-metallic materials by laser pulse-periodic exposure has been implemented. The image of area of a brass sample heating with formation of a whitish-grey film on the surface is shown in Fig. 1. The nanowires of zinc oxide formed on the surface of brass during pulsed-periodic laser irradiation are shown in Fig. 2.

CONCLUSION

A progressive method of producing nanoporous structures has been created. It has been determined that laser treatment of brass in vacuum forms a nanoporous structure in the near-surface layer. A synergistic effect between thermal effects of laser irradiation and pulsed-periodic laser-induced vibrations is studied, which provides a significant increase of the diffusion coefficient in the material. It should be noted that the presented research has initiated the development and application of methods for the formation of material structures with improved physical and mechanical properties by laser irradiation with predetermined intensity distribution of a powerful laser beam. The formation of nanoscale carbon and mixed carbon-carbide coatings provides an opportunity to improve the corrosion properties of metal optical surfaces, which also increases the reliability and resource use of laser optics for beam shaping.

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