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OBSAH

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Hybrid laser systems for thin layers

(M. Jelínek, J. Remsa, T. Kocourek, M. Tyunina, A. Dejneka, J. Mikšovský, P. Písařík)91
Lasers found their way into many applications. One of them is utilisation of lasers in material research. This paper is focused on laser method of thin layers preparation and on hybrid laser technologies combining laser with magnetron, with radiofrequency discharge, and ion bombardment of layers. Hybrid systems significantly widen the field of laser deposition a quality of prepared coatings. Basic principles and applications in optoelectronics and v biomedicine are discussed.

Keywords: PLD, laser, hybrid system, thin films, magnetron, ion gun, biomaterials, optoelectronics

Design and fabrication of diffraction element intended for application in hyperspectral imaging system for LWIR (P. Vojtíšek, M. Possolt, R. Doleček, K. Steiger, P. Pintr, J. Václavík)96

Hyperspectral imaging as a tool for obtaining information about the world around us is rapidly developing field of modern technology. The desired information in such systems is obtained by processing of stored spectral information of a measured scene. The main advantage of the hyperspectral systems is the use of a wide spectral range encompassing both the visible and adjacent spectral regions (primarily infrared). The main element in these systems is a spectrally selective element which provides separation of the individual spectral components. This element can be based on number of physical principles, in this paper we will discuss the design and fabrication of a spectral element based on a diffraction grating. The main requirements for this system were: spectral division function for LWIR (7 mm – 14 mm), the highest possible efficiency in this spectral region with respect to the spectral emission of a black body with temperature 350 K, and avoidance of the restrictions given by the production. Design of the grating was done with the use of a scalar theory and the results were compared with RCWA and finite element method. Fabrication of the grating was carried out using single-point diamond turning. The grating was made of germanium.

3D form inspection of grinded optical surfaces by digital holography (P. Psota, V. Lédl, P. Vojtíšek, R. Doleček).....101

This paper presents the method for shape measurement by digital holography based on wavelength contouring. The method employs multiple measurements from different illumination directions followed by stitching of the individual measurements by least square method. This approach is promising in measuring of steeper surface slopes more accurately.

Keywords: shape measurement, multiwavelength, digital holography, contouring, grinded surfaces, least square

Digital holographic interferometry applied for very small vibration amplitudes measurements (R. Doleček, P. Psota, V. Lédl, V. Kopecký)105

This paper shows the comparison of a vibration measurement simultaneously performed with three different methods on the same sample. The aim of the paper is to experimentally prove the capability of a newly developed method for the measurement of vibrations with amplitudes in a nanometre range. The newly developed method is based on frequency shifted time averaged digital holographic interferometry combined with phase shifting and the phase averaging principle. The methods used as a benchmark are Doppler vibrometry performed with a commercial single point vibrometer and a single point interferometer in a Michelson

construction which is improved with the lock in principle. The results have been compared and very good agreements between the results are shown.

Quantitative microstructural characterization of transparent YAG ceramics via microscopic image analysis using stereological relations (T. Uhlířová, J. Hostaša, W. Pabst, L. Esposito).....109

The microstructure of transparent yttrium-aluminum garnet (YAG) ceramics is characterized using different microstructural descriptors, with special focus on grain size numbers. Both linear and planar grain size numbers are used to describe the dependence of the average grain size on Yb dopant content (0 – 10 at. %), sintering additive (tetraethyl orthosilicate, TEOS) content (0.3 – 0.5 wt. %) and firing time. Although the two grain size numbers are very close for the materials studied (with ratios very close to unity, around 0.987 ± 0.109), these two numbers are principally independent and provide complementary microstructural information. Their relations to other microstructural descriptors (interface density, mean curvature integral density, mean chord length, Jeffries size) are discussed throughout the text. It is found that Yb doping of more than 3 at. % has a grain-growth-inhibiting effect (after sufficiently long firing times), but differences in the TEOS content between 0.3 and 0.5 wt. % do not have any sensible effect. The largest effect on the microstructure is exerted by the firing time (with prolonged firing times leading to grain growth), but with higher Yb doping the effect of firing time on the grain size becomes less pronounced: for YAG samples without Yb doping, increasing the firing time by a factor of 8 (from 2 h to 16 h), decreases the grain size number by 33.2 – 35.0 %, whereas with a Yb dopant content of 10 at. %, the corresponding decrease in the grain size number is only 8.7 – 10.0 %. These findings are fully corroborated using the other microstructural descriptors.

Keywords: transparent ceramics, YAG (yttrium aluminum garnet), image analysis via stereological relations, mean chord length, Jeffries size, interface density, mean curvature integral density, ASTM (equivalent) grain size number

Non-destructive testing of composite materials after machining (Z. Hutýřová, D. Mital, M. Harničárová, J. Valíček, M. Kušnerová, R. Grznárik)114

The goal of this paper is focused on non-destructive testing of new kind of composite material – wood plastic composite (WPC) after technological operation of turning and after process of extrusion (before machining). From theoretical point of view the quality of the surface during turning is directly dependant on a combination of nose radius and feed. In the case of machining the composite materials that are WPC based, this statement does not apply because the shape of the surface is conditioned by the compatibility of the material. Detection of surface defects were used visual inspection and capillary method. X-ray scanning (metrotomography) was used for detect of defects in volume – it is possible to state a course of defects in different layers – cross section along thickness. The anomalies (cracks) on the surface after machining were clarified by using RTG scanning.

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