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Institute of Physical Engineering and CEITEC – the time of mutual learning and adaptation (T. Šíkola) 167

The article presents an overview of the activities of the Institute of Physical Engineering (Faculty of Mechanical Engineering, Brno University of Technology) in building a Central European Institute of Technology which brings together scientists from several Brno universities and research institutions. The Institute staff is involved in the preparation, implementation and coordination of research, especially in the field of material sciences and nanotechnology.

Application of scanning near field optical microscope for plasmonics (L. Břínek, P. Dvořák, T. Neuman, T. Šamořil, P. Dub, R. Kalousek, T. Šíkola) 169

The article deals with measurements of surface plasmon polaritons via scanning near field optical microscope. Interference patterns of surface plasmon polaritons have been measured between pairs of excitation grooves fabricated by the focused ion beam on the metallic surface. Interference patterns in the space among excitation grooves depend on the mutual angle between the grooves and the polarization state of the incident electromagnetic field.

Coherence-controlled holographic microscope and its application at IPE BUT (A. Křížová, J. Čolláková, R. Chmelík) 171

Coherence-controlled holographic microscope was developed and designed at IPE BUT. This technique uses off-axis holography in connection with achromatic interferometer. Advantages of this method are quantitative phase imaging, image reconstruction from one hologram, imaging through turbid media and numerical refocusing. Next basic biological applications such as long-term observation of living cells, monitoring of cell reactions to external stimuli, and imaging cells in turbid media, which this technique is advantageous to use for, are shown in the article.

Incubation device for living cells observation in coherence-controlled holographic microscope (M. Antoš, J. Čolláková, R. Chmelík) 174

Coherence-controlled holographic microscopy (CCHM) is designed mainly for living cells observation. In order to determine quantitative phase changes in CCHM caused by an observed object it is necessary to reduce random local fluctuations of the reference and the object wavefront. The temporal thermal instability of the frame and of microscope's optical elements causes random changes of optical path difference between the reference and the object beam. Here we demonstrate the new incubation device which keeps the constant temperature of the whole microscope and observation chamber. The designed device also minimizes undesirable optical phase changes caused by thermal dilatations of the microscope and by air turbulences and it also provides optimal living conditions for the observed cells. Effective use of enclosure's and flow chamber's potential is demonstrated by observing reactions of living cells before and after cultivation medium replacement.

Mobile apparatus for remote material analysis by laser induced breakdown spectroscopy (J. Novotný, M. Brada, M. Petrilak, D. Procházka, J. Kaiser) 177

Laser induced breakdown spectroscopy (LIBS) is a fast and contactless method for a spectrochemical material analysis. The mobile remote modification of the basic setup is unique device with the ability to determine elemental composition of the sample in situ. Laboratory of laser spectroscopy is engaged in the development and applications of methods LIBS for more than 15 years. In the last few years the attention is also aimed to the development of the mobile device for the stand-off variation of the LIBS technique. The actual state of development is discussed together with the description of the optical design, construction, instrumentations included and measurement test for the distance of 6 m. Actual and following development stages are also mentioned.

Keywords: LIBS, spectroscopy, laser, plasma, stand-off, remote analysis

Inspection of optical fiber connector dimensions by means of computed tomography (T. Zikmund, M. Petrilak, J. Novotný, M. Liška, J. Kaiser) 181

In this paper we present the utilization possibilities of X-ray computed tomography with high spatial resolution – X-ray microtomography (μ CT). For demonstrating the possibilities of μ CT, an analysis of an F-SMA standard SMA connector (SMA 905, Type 1) employed in the setup for Laser-Induced Breakdown Spectroscopy (LIBS) was carried out.

Keywords: computed tomography, CT, μ CT, SMA connector

Characterization methods of graphene (Z. Lišková, P. Procházka, M. Bartošík, J. Mach, M. Urbánek, T. Šíkola, M. Ledinský, A. Fejfar) ... 184

Graphene, a monolayer of carbon atoms arranged in a hexagonal grid, has been during the last decade an object of great interest to scientists for its unique mechanical, electronic and magnetic properties both in terms of theory and application. This article discusses the methods of graphene preparation by the mechanical exfoliation and chemical vapour deposition (CVD). At the same time the attention is focused on the characterization of graphene films using optical microscopy, reflectometry, micro-Raman spectroscopy and atomic force microscopy (AFM), which are essential in determining the quality of graphene layers and improving their preparation.

Keywords: graphene, mechanical exfoliation of graphite, CVD graphene, Raman spectroscopy, reflectometry, AFM

Device for analysis of silicon wafers

(D. Šulc, P. Wertheimer, M. Páleníček, T. Šíkola, L. Válek) 187

The aim of this work was a design of the device for defects analysis (stacking faults) of silicon wafer manufactured by Czochralski method. This device can analyze wafers of diameter up to 200 mm automatically. Hardware consists of optical microscope, positioning motorized xy stage, control electronics. Controlling and evaluating software, which has been developed as well, identifies, localizes and characterizes wafer defects. The device was developed in co-operation with company ON Semiconductor, Czech Republic.

Keywords: silicon wafer, Czochralski method, defect analysis, OISF test, positioning xy table, image analysis

System for characterization and optimization of piezoactuators

(Z. Nováček, M. Pavera, J. Neuman, T. Šíkola) 190

An automated system for the optimization of piezoactuators is introduced. The system drives an actuator by high voltage pulses of different shapes and measures its response using an optical interferometer unit. The resulting set of pulse parameters ensures not only a high speed of the actuator but also its reliable operation.

Keywords: piezo, stepper motor, interferometer, piezoactuator optimization, LabVIEW

Effective generation of Rayleigh's surface wave (J. Dvořák) 193

The article deals with an analysis of physical conditions in the material of a meander magnetizing coil for the purpose of generating a Rayleigh's surface wave. The aim of the analysis was to determine the necessary conditions for the effective generation of ultrasonic waves, when the induction field vector must be oriented outwards from the material. The coil must be planar and symmetric with even number of turns. The pitch of the turns has not to exceed the ultrasonic wavelength.

Keywords: Rayleigh's surface wave, physical conditions, electromagnetic field

Conference Focus on Microscopy 2013 was focused on advanced techniques (J. Pala) 195

Probably the biggest conference that involves advanced microscopic methods Focus on Microscopy was held in Maastricht in March 24 – 27, 2013. There was presented over 440 contributions in the form of invited and standard oral presentations and posters. The newest available technologies were introduced by more than 50 companies, the main sponsor was German company Leica Microsystems GmbH oriented on the most advanced techniques in the optical microscopy.

Measurement technique – the ground of advance technologies

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