

JEMNÁ MECHANIKA A OPTIKA

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Physical engineering and nanotechnology - qualitative enhancement of teaching optics and fine mechanics

(M. Liška, T. Šíkola) 195
The accreditation of the new curricular programme is based on the extension of teaching of ray and particle optics; on the design and construction of devices with advanced opto-mechanical components and on the tutoring the methods and devices for creation and analysis of nanostructures.

Light at Institute of Physical Engineering (T. Šíkola) 196

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(T. Šíkola) 197

Specialized laboratories for accredited study program Physical engineering and nanotechnology

(S. Průša, M. Liška, T. Šíkola) 198
A new physical laboratory for students of Physical engineering and nanotechnology study programme is based on experiments from the field of modern physics and on advanced imaging techniques with nanometre scale resolution. The experiments and their interpretation form base for study of the modern physics and nanotechnology.

Keywords: experiment, physics, education, nanotechnology

Development of a mobile remote laser induced breakdown spectroscopy system: Laboratory setup

(J. Novotný, J. Kaiser, R. Malina, M. Liška, A. Hrdlička, K. Novotný, M. Galiová) 200
The first stage of the Laser Induced Breakdown Spectroscopy (LIBS) setup development for the mobile remote sensing of chemical elements is presented. In this stage the laboratory test setup has been built using Nd:YAG laser (radiation wavelength 532 nm, at-top beam profile), custom built Galilean focusing optics together with the off-axis Newtonian collection optics for plasma radiation detection. The capability of the setup has been tested in the distance of 6.2 m on selected samples with different matrices (metal, bone, paving stone, glass). The measured concentrations have been compared to results acquired by reference LA-ICP-MS setup.

These test measurements have shown that the setup is capable of semiquantitative analysis at the level of mg·kg⁻¹.

X-ray microradiography and microtomography

(R. Malina, J. Kaiser, M. Liška) 203
The paper deals with selected application of X-ray microradiography and microtomography for imaging of the inner structure of 2D or 3D objects with high planar or spatial resolution, respectively. Special techniques of imaging that utilize phase contrast and dual-energy microradiography and microtomography are described.

Digital holographic microscopy at IPE, BUT

(P. Kolman, H. Janečková, R. Chmelík) 206
Paper refers about the digital holographic microscopes (DHM) developed and constructed at the Institute of Physical Engineering (IPE FME, BUT). These microscopes are unique in combining off-axis holography with achromatic interferometer. The advantages of this combination are summarized in the paper. Living cells study – one of the most usual applications of the transmission DHM – is presented together with a new method for quantitative visualization of cell's dry mass dynamics: dynamic phase differences.

Ion mechanics as a tool for nano-world analysis

(P. Bátor, R. Duda, S. Průša, T. Matlocha, M. Kolíbal, R. Kloušek, J. Neuman, M. Urbánek, T. Šíkola) 209
In the contribution the results on the combination of ion sputtering and scattering processes for achieving enhanced complementary information on the analyzed multilayer are reported. Physical background of ion-solid interactions is discussed. Specifically, the combination of SIMS and TOF-LEIS techniques will be introduced.

Keywords: SIMS, TOF-LEIS, HRTEM, depth profiling, ion interactions, ion scattering, MoSi

Sample manipulator for X-ray photoelectron spectroscopy compatible with ultra high vacuum

(J. Polčák, P. Bátor, J. Čechal, T. Šíkola) 215
X-ray photoelectron spectroscopy (XPS) is a well established technique which cannot be omitted in any surface and thin film laboratory. We report on construction of an automated sample manipulator which enables sample positioning in three axis and sample rotations in polar and azimuthal angles. The automatization enables an easy obtaining of angle resolved data or X-ray photoelectron diffractograms.

Keywords: X-ray photoelectron spectroscopy; XPS; ARXPS; ultra high vacuum; UHV; manipulator

Application of thermal desorption spectroscopy for surface contamination investigation

(M. Potoček, P. Bátor, T. Šíkola) 217
Theoretical basics of thermal desorption spectroscopy and its realization in the Surfaces and Thin Films Laboratory is presented. As an example of application of this method a study of contamination of Si wafer is reported.

Keywords: Thermal desorption spectroscopy, TDS; desorption; adsorption

International trade fair of ophthalmic optics SILMO

Study of optical properties of nanostructures by scanning near-field optical microscopy

(D. Škoda, R. Kalousek, O. Tomanec, M. Bartošik, L. Šustr, T. Šíkola) 219
Optical properties of periodic structures and one-dimensional nanowires have been studied by Scanning Near-Field Optical Microscopy (SNOM). The optical waveguide connected to the tuning fork detector was used for the illumination of the sample or the collection of electromagnetic field close to surface of optically active structures. This contribution presents the ability of new instrument – scanning near-field optical microscope – and the recent results on studied nanostructures.

Guided growth of cobalt islands on silicon substrate

(J. Čechal, J. Polčák, O. Tomanec, T. Šíkola) 222
We have presented a straightforward method for fabrication of patterns of cobalt islands. The focussed ion beam lithography has been used to locally modify a native SiO₂ layer on a silicon substrate. On the modified areas preferential nucleation of cobalt islands is observed due to a reduced surface diffusion of Co atoms in the vicinity of FIB modified areas. Using this method ordered arrays of islands with given size and positions may be prepared.

Keywords: Thin films; Nucleation; Guided growth; Focused ion beam SiO₂; Cobalt

Sensitivity analysis of optical parameters fitting procedure

(J. Spousta, J. Zlámal, M. Urbánek, T. Běhounek, R. Pišek, R. Kalousek, T. Šíkola) 225
Article deals with a sensitivity analysis of fitting procedure: theoretical model of reflectance is fitted to an „ideal“ data by applying Levenberg - Marquardt algorithm in order to determine optical properties, their accuracy and reliability factor used to quantify a convergence successfulness of the reflectance model at given set of starting parameters vector.

Application of spectroscopic reflectometry to the study of elastohydrodynamic lubrication

(V. Čudek, I. Křupka, M. Hartl) 229
Paper deals with the application of spectroscopic reflectometry for the central lubrication film thickness measurement in elastohydrodynamic contacts. This approach overcomes the main limitations of other measurement techniques used for film thickness measurements in tribological problems studies and provide absolute data that eliminates the relative comparison between calibration table and measured lubrication film.

From technical library

(I. Brezina) 231