

# JEMNÁ MECHANIKA A OPTIKA

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**Application potential of nanomaterials** (P. Louda) ..... 3  
The article presents the Institute for Nanomaterials, Advanced Technology and Innovation, as an institution that provides knowledge transfer from academia to industry and thus supports its innovative potential.

**Specifics of plant surfaces and analogous structures design methodology for technical application**

(D. Kroisová, J. Ron, A. Petráň) ..... 5  
The surfaces of many plants express specific hierarchical structures. These plant structures often provide water repellent surface behaviour, which is important for the course of photosynthesis and reproduction. In a technical practice, it would be advantageous to make use of analogous structures, which would be achieved or hydrophobic self-cleaning behaviour of surface materials. The aim of this paper is to show works leading from microscopic observation of plants surface to design analogous structure.

**Keywords:** plant surfaces, hierarchical structures, hydrophobic behaviour

**Light optical microscopy and scanning probe microscopy in haematology** (P. Kejzlar, L. Voleský, E. Macajová, L. Bergerová) ..... 8

Present article describes the methodology and usage of a connection of light optical microscopy and scanning probe microscopy. Through the connection of these different microscopic methods it is possible to obtain high resolution 3-dimensional image of real sample surface supplemented by the possibility of mechanical or other properties measurement (Young modulus, adhesion, electrical and thermal conductivity, magnetic properties etc.) in the region of interest found by the light optical microscopy. This could be achieved through the Direct Overlay feature which enables correlation of light optical image and a scan obtained by the atomic force microscopy. The usage and potential of this function is demonstrated on the blood smear

**Keywords:** light optical microscopy, atomic force microscopy, scanning probe microscopy, haematology, blood cell

**Evaluation of residual stress by Barkhausen noise analysis in the comparison with the X-ray diffraction**

(L. Vrkoslavová, T. Bakalová) ..... 11  
Structure of the material in the surface layer and the strain field on the surface of the workpiece are significantly influence by technological conditions of production of the machine components. Condition of the surface layer after grinding is an important factor for the quality and reliability of machine parts. Therefore, great emphasis is placed on control components mainly for grinding and heat treatment with the requirement of rapid and reliable inspection control of mass-produced components. This article mainly compares the X-ray diffraction method with the method of analysis of Barkhausen noise and demonstrates the use and reliability of this method. Comparison of these methods has been carried out during the grinding of gears.

**Measurement of light alloys small porosity by eddy currents in finished surfaces** (O. Kovacs, B. Skrbek, A. Zyska) ..... 14

This contribution is dealing with investigation of porosity in extent upto 2 % of casting alloys of Al-Si type, so called silumines; it continues in previous successful research of non-destructive measurement of porosity in extent up to 20 %. Potential of prediction by non-destructive methods. Technology process of castings manufacturing with constant porosity in the whole volume. This work evaluates porosity degree with application non-destructive method of eddy currents and microscopy quantification of porosity. Mathematical and graphic results. Application perspective in industry.

**Keywords:** casting alloys, porosity, eddy currents, microscopic prediction

**Laboratory of nanolayer evaluation**

(Z. Rozek, M. Fijalkowski) ..... 17

**The use of scanning probe microscopy for a thin layer quality control**

(L. Voleský, P. Kejzlar, Z. Rozek) ..... 19

It is possible to modify physical and chemical properties (e.g. hardness, corrosion and abrasion resistance, friction coefficient...) of base material through the thin layer deposition. The scanning probe microscopy could be used for the precise characterization thin layer properties. Through the scanning probe microscopy it is easily possible to determine e.g. 3D topology, nanohardness, elasticity, adhesion, electrical and thermal conductivity etc.

**Keywords:** scanning probe microscopy, atomic force microscopy, structure, thin layer

**Image analysis as a basis for the use of ultrasonic structuroscopy**

(Z. Andršová, P. Kejzlar, L. Voleský) ..... 21  
Possibilities of optical microscopy lie not only in the acquisition of the image but even in its processing. It is possible to acquire a number of other very valuable information about the structure and material properties. These findings can then be advantageously evaluated in practice. This paper demonstrates an example of the use of sophisticated image analysis as a support for one of the methods of non-destructive structuroscopy commonly applied to the diagnostic of iron castings.

**Keywords:** light optical microscopy, image analysis, ultrasonic structuroscopy

**The use of correlative microscopy for the structural examination of Fe-Al-Zr-based materials** (P. Kejzlar, E. Macajová) ..... 25

The correlative microscopy is a relatively new method enabling a connection of dates coming from light optical microscopy and scanning electron microscopy including chemical analysis. In the present paper the correlative microscopy had been used as an effective tool for examination of Fe-30Al-5Zr alloy structure.

**Keywords:** correlative microscopy, optical microscopy, scanning electron microscopy, energy-dispersive analysis, structure, intermetallic

**Significance of the projectiles kinetic energy in test interpretation of armour ballistic resistance by DOP method**

(M. Liška, M. Matušek, D. Šída, V. Šída) ..... 27  
In the article a relationship between the kinetic energy of the projectiles and values of *DOP* (depth of penetration) for optical transparent and non transparent ceramic materials will be discussed.

**Prof. Ing. Pavol Horňák, DrSc. in his seventieth** (I. Saran) ..... 36

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# ANOTACE

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**Nanokompozitní biosorbent (magnetit – pryskyřice karaya) pro odstraňování radioaktivních fosfátů** (V. V. T. Padil, M. Černík) ..... 3

Nanokompozity z pryskyřice karaya a oxidů železa byly připraveny společným vysrážením iontů Fe<sup>2+</sup> a Fe<sup>3+</sup> použitím roztoku čpavku za přítomnosti pryskyřičného hydrokoloidu. TEM analýza ukazuje na přítomnost téměř kulových částic oxidu železa o průměru mezi 10 nm a 15 nm. Naše XRD výsledky potvrdily již dříve pozorovanou krystalinitu nanočástic oxidu železa. Maximum adsorpce (97.5 % ± 1.5 %) radioaktivního fosforu nanokompozitem byla zjištěna při pH 5 a teplotě 25 °C. Výsledek naznačuje, že 32P interaguje s karboxylovými, hydroxylovými, karbonylovými a acetylenovými skupinami pryskyřice karaya stabilizované magnetitem.

**Model fluorescenčního detektoru Observatoře Pierra Augera v prostředí ZEMAX** (T. Rössler, M. Pech, M. Hrabovský, D. Mandát, L. Nožka, M. Palatka, P. Schovánek) ..... 32

Článek pojednává o fluorescenčních teleskopech používaných Observatoří Pierra Augera v Argentině jakožto detektorů fluorescenčního světla generovaného interakcí vysoce energetických kosmických částic se zemskou atmosférou. Nejdříve je vysvětlen účel Observatoře a úloha fluorescenčních detektorů. Pak následuje popis konstrukce teleskopu, je představen náš model teleskopu v prostředí ZEMAX doplněný několika výsledky simulace. Je také diskutována přesnost modelu a jeho budoucí vývoj.

**Klíčová slova:** Observatoř Pierra Augera, fluorescenční detektor, ZEMAX