

# MANUFACTURING TECHNOLOGY

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- Model of patient's distal femoral part and final model of the femoral component.
- John Moores University in Liverpool, Great Britain, Invitation on ICPM 2011

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## Analysis of development grinding wheels on the basis of microcrystalline corundum

Prof. Eng. Karel Kocman, Sc.D.

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**Grinding is a finishing operation featuring high precision, correct geometrical form and usually a very good surface quality. One of the factors necessary to achieve needed values is a correct choice and quality of the grinding wheel. The development of new technologies in the field of finishing functional surfaces has been focused on the production of new advanced grinding materials ensuring higher efficiency and reduction of the temperature of contact between the ground surface and the grinding wheel. The desired result is enhanced quality of the ground surfaces. One of the feasible ways of giving a solution to the problem is the application of highly porous grinding materials, sintered corundums. The presented article is focused on the analysis of development grinding wheels containing microcrystalline corundum.**

**Keywords:** Prediction, thermodynamic effects, thermal balance, grinding, Flir 2000

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### Reviews:

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## Development of Grinding Wheels for Tools Manufacturing

Prof. Lukovics Imrich, MSc., Ph.D.<sup>1</sup>, Bílek Ondřej, MSc., Ph.D.<sup>1</sup>, Dr. Holemý Stanislav, MSc.<sup>2</sup>

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**This paper deals with the possibility of using sintered corundum of grinding tool parts. It assesses the impact of technological conditions on cutting forces during grinding, the tool wear and the quality of machined surfaces, provided changes in concentrations of grains in sintered corundum grinding wheel.**

**Keywords:** Grinding, Sintered Corundum, Cutting Forces, Quality

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**Reviews:**

*Prof. František Holešovský, MSc., Ph.D.*

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## Modelling of Transient Thermal Stress in Layered Walls

Assoc. Prof. Oldřich Šuba, MSc., Ph.D.; Assoc. Prof. Libuše Sýkorová, MSc., Ph.D.; Martina Malachová, MSc. et MSc.; David Sámek, MSc., Ph.D.

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**Results of FEM modelling of transient thermal stress analysis in layered walls are given in the article. It is shown that thermal stress alone is not solely caused by differences in coefficients of thermal expansion of individual layers. The emergence of transient thermal stress is subject to both the layered structure of the wall and given boundary conditions, as well as the existence of a temperature gradient in the direction normal to the surface of the wall. A practical application focuses on the issue of recycling of PCB boards with the effort to achieve separation of layers due to thermal stress. Role modelling of thermal stress in this area lies in predicting the possibility of separation, depending on the type of thermal stress and material parameters.**

**Keywords:** transient thermal stress analysis, layered walls, PCB boards, FEM modelling

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### Reviews:

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## Parameterization of apparatus TELIT

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**Nowadays every reliable activity simplification leading to time saving is an important positive. The constraint of customers to documentation of mechanical properties just on castings is everlasting. It can be achieved without submission of casting to destructive testing, by non-destructive structuroscopy. This contribution describes the possibility of non-destructive determination of ultimate tensile strength of castings of graphite cast irons using TELIT structuroscope and parametrization of mathematical model for non-destructively determined strength using this instrument.**

**Keywords:** Structuroscopy, shape of graphite, strength, cast iron

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### Reviews:

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## Die Casting Plunger Pressing Velocity and Analysis of Its Influence on a Permanent Deformation Value of a Casting Made from an ENAC 47100 Alloy

Assoc. Prof. Paško Ján, MSc., PhD., Department of Technical Devices Design, Technical University of Košice, Faculty of Manufacturing Technologies with seat in Prešov, Slovak Republic

**A die casting plunger velocity inside a filling chamber of a pressure die casting machine is one of the most significant factors of a pressure die casting. This velocity determines the regime of a die cavity filling, thus influencing both inner and surface quality of castings. A selection of a correct velocity of a die cavity filling depends on such factors as an alloy type, a casting complexity, a ratio of a slot area to a casting area, etc. A static pressure test can be used to determine a permanent deformation value by which a casting quality can be considered.**

**Keywords:** die casting plunger pressing velocity, ENAC 47100 alloy, permanent deformation, homogeneity of a casting

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### Reviews:

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## Analysis of anti-corrosion coating process on steel constructions

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**Nonconformities identified in *anti-corrosion coating process* on the steel constructions were analyzed in the article. Analysis of these nonconformities allows for process improvement by finding new ways of process leading.**

**Keywords:** quality, anti-corrosion coating process, nonconformities

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### Reviews:

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## Computer Tomography in Comparison with Other Testing Methods Used for the Leakage Testing of HPDC Parts

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**Computer tomography could be used for non-destructive inspection of castings. This contribution deals with application of computer tomography for determination of inner quality of high-pressure die casting parts, especially in relation to leakage and compared with other testing methods. In praxis, the leakage location is identified by fracture test or by metallographic observation. Often the oxides and porosity are found. Porosity is also often found out after machining operations. This work proposes non-destructive methods of castings inspection, especially tomography, in comparison of other known and available methods, with the goal to find out the problem before machining with minimal losses.**

**Keywords:** Pressure Tightness, Leakage, High Pressure Die Casting, Computer Tomography.

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### Reviews:

Prof. Přemysl Pokorný, MSc., Ph.D.  
Assoc. Prof. Štefan Michna, MSc., PhD.

## X-Ray Photoelectron Spectroscopy for industrial applications

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**The X-Ray Photoelectron Spectroscopy is versatile technique based on high energy photon stimulation. The investigated areas of the sample are about the top 10 nm. The basic composition and chemical bonds can be evaluated. The XPS can be used in the quality control, ageing studies and many more. Samples of CoSbY alloy, carbon-rich coatings and films with tin were investigated here.. The importance of proper handle on carbon contaminations on CoSbY alloy is illustrated. The chemical shift of carbon C 1s peak and oxidation state tin Sn 3d photo electron peaks are presented.**

**Keywords:** XPS, ESCA, surface analyses

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### Reviews:

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## Grinding and surface quality parameters at automotive parts machining

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**This paper deals with grinding of the automotive parts and surface quality after grinding. This paper describes results from the experiment with grinding of materials EN ISO 100Cr6 and EN ISO C55E used in automotive industry like materials of the machine parts. This experiment shows possibilities with grinding of this materials and the influence of the ground process parameters during grinding e.g. normal and tangential force, cutting fluids and feed. Together with this experiment is evaluated also the surface quality of machined parts. The evaluated parameters of surface quality were choice roughness and geometrical accuracy – roundness.**

**Keywords:** Cutting forces, feed, grinding surface quality

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### Reviews:

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## The wood requires orthogonal cutting

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**This paper deals with problems about the wood requires orthogonal cutting and its history and presents development.**

Keywords: Parameter  $R_z$ , turning, wood

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### Reviews:

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## Possibilities and limits of adhesive layer thickness optical evaluation

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**The uniform adhesive layer thickness belongs to the key criterions of the bonded joint formation. On the basis of long-term laboratory findings it was evaluated as one of basic effects on the strength changes. This fact leads to the objective evaluation necessity and to the technical practice respecting. The carried out laboratory experiments are indicative of the incongruity between the expected adhesive layer thickness and the real value determined in the bonded joint square cut using the microscope.**

**Keywords:** Adhesive bond, adhesive layer thickness, microscope

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**Reviews:**

*Prof. Iva Nová, MSc., Ph.D.*  
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## Interaction of steel surface treatment by means of abrasive cloth and adhesive bond strength

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**This paper deals with the surface texture influence of by hand grinded steel specimens using abrasive cloth of different grit on the resultant bonded joints strength. This method is often used in repairing and on places where the application of mechanical grinding is not possible. Determination of the optimal surface finish is the necessary step at the bonded joint realization. The evaluation of the roughness influence on the strength characterizations was carried out according to the standard CSN EN 1465 by the use of two two-component epoxy adhesives, namely Bison epoxy metal and Lepox 1200. Bonded specimens were made from the constructional plain-carbon steel S235J0. From carried out tests it followed not only the necessity to perform the specimen surface mechanical finish before bonding, but the optimal grit of the abrasive cloth for the concrete tested material was determined, too. The use of the unfit selected abrasive cloth, or its use with the unfit selected adhesive layer thickness, can cause the expressive loss in tensile strength of the bonded joint.**

**Keywords:** Adhesive bond, adhesive layer thickness, hand grinding, optimal surface finish

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**Reviews:**

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## Non-destructive analysis of surface integrity in turning and grinding operations

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**This paper deals with application of Barkhausen noise for analysis of surface integrity in turning and grinding operation. The stress state is analyzed in relation to tool wear. The results of measurements show that the residual stresses are not homogenous on the machined surface. This homogeneity depends on tool wear and stability of cutting process. Application of non-destructive testing through the Barkhausen noise is more suitable for grinding operations. Application of Barkhausen noise testing for turning operation will require the next research.**

**Keywords:** Barkhausen noise, residual stress, grinding, turning

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### Reviews:

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## Technology of processing CT data of the Knee Joint

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**Alloarthroplastic is the basic surgery method in orthopaedics, which handles the insult to the normal human joint function [1]. Achieving of advance in development of knee replacements is possible only on the basis of complex and deep knowledge of those problems and on experimental judgment of physical properties of used materials including successful implantation before introduction into the practice. In orthopaedics, technology of 3D models creation and theirs application is at the beginning and there is an effort to decide what effective manner has to be used for total benefit from the viewpoint of patient medication. This long-term task can be verified only in practice.**

**Keywords:** Knee Joint, Reverse Engineering, CAD software, Rapid Prototyping, CT data.

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**Reviews:**

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## Examination of the structure and the phase composition of the alloy Fe<sub>30</sub>Al<sub>5</sub>Zr

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**Light optical microscope, X-ray diffraction as well as scanning electron microscope equipped with energy-dispersive X-ray analysis system were used for examination of the structure and the phase composition of the Fe<sub>3</sub>Al-based material alloyed with 5 at. % of zirconium in the state as cast and after heat treatment. The occurring phases were identified, their volume fraction in the alloy was determined and the effect of the heat treatment on the structure of the investigated material is described and discussed.**

**Keywords:** Intermetallics, Iron aluminides, Fe-Al-Zr, Structure, Phase composition

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### Reviews:

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## Laser scanning confocal microscopy as a powerful tool for fracture surface characterization.

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**The aim of this paper is to show the applicability of the Laser Scanning Confocal Microscopy (LSCM) for the fractographical research of the compact tension specimens. Scanning Electron Microscopy (SEM) together with Light microscopy (LM) are prevailing techniques for the fracture surfaces examination [1,2]. Information about the surface topography obtained by LM and SEM is reflected in 2D image whereas LSCM provides 3D images. In this work the fracture surfaces of the compact tension specimen were examined by LSCM and by SEM and the main features as cleavage facets, ductile dimples, stretch zone and fatigue were observed.**

**Keywords:** LSCM, SEM, fractography, 3D image

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### Reviewers:

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## An improvement of tribological properties of boron alloyed layers

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In presented paper we described studies of resistance of selected material in abrasive wear tests. A surface of tested materials was remelted with TIG method in a compound of gases of argon and B<sub>4</sub>C. Analysing tests results we found out, that the most abrasive wear resistant material was sample of steel 11 373 and 12 050. The process of remelting by using electrical arc in gas atmosphere generates the conditions that allow creation of steady structures of mechanical properties and higher wear resistance. Materials 11 373 and 12 050 were used for verifying those facts with comparison to etalon 12 014.

**Key words:** abrasion, shield, friction.

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## Surface integrity of hardened bearing steel after milling

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**Demands on a surface layer quality of machined components are still increasing with increasing of machining productivity. Changes of mechanical properties in the thin surface layer of a workpiece occur due to thermal and deformation effects of the cutting tool during machining. The aim of the present paper is a study of the surface layer of samples from hardened steel (14th grade of steel), which were milled using machines produced by TOS Varnsdorf a.s. The samples were milled with different tools from five manufacturers. Parameters of surface integrity, which comprehensively reflect the quality of surface layer after milling, were evaluated after the machining.**

**Keywords:** metal cutting, milling of hardened steel, surface integrity, measurement

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### Reviewers:

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## Compressor maintenance supported by tribodiagnostics

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**Quality product is dependent on reliable and serviceable manufacturing facility, which is influenced by effective and timely performed maintenance, including checking and refilling of lubricants and other vital fluids. For assessing the state of lubricants and parts of manufacturing machinery, it is possible to use a series of analysis including, for example particle counter and particle shape classifier LaserNet Fines-C, flash point, kinematic viscosity, water content, determination of solid particles, wear metals, etc. Each analysis used to assess technical condition of lubricating oil and machine and helps to carry out maintenance at appropriate intervals, which are directly affected by the technical condition. Such maintenance system achieves economic savings over the maintenance performed in a tightly planned and schedule. The paper compares examples of oil analyses of two compressors.**

**Keywords:** wear, maintenance, tribodiagnostics, LaserNet Fines-C

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