

# MANUFACTURING TECHNOLOGY

December 2011, vol. 11, No. 11

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Cover sheet photos:

- Morphology of eutectic silicon, p. 75, authors: Tillová E. et al.
- ICPM 2001 in Liverpool, Great Britain, photo: editors.

The journal is ranked by the Czech Government Council for R&D and Innovation among peer-reviewed, non-impacted periodicals published in the Czech Republic.

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## Print

PrintPoint Ltd., Prague,  
Czech Republic

## Publisher

J. E. Purkyne University in Usti nad Labem  
Horeni 13  
400 96 Usti nad Labem  
Czech Republic  
IN: 44555601  
VAT: CZ44555601

Issue: 200 pcs.  
published in December 2011

84 pages

© FPTM JEPU

Price: 15 EUR or 20 USD

**Permission: MK CR E 20470**

**ISSN 1213–2489**

**ISBN 978–80–7414–415–8**

## The Kaizen philosophy in the aluminium products improvement

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**Kaizen strategy is the most important Japanese management concept. Supporters of this by all means an interesting management philosophy consider it as a basis for achieving success by the company. The analyzed company X Stainless motivated by others companies market successes decided to deepen the knowledge of the Kaizen philosophy, which resulted in the implementation of this method of management in its ranks. The essence of Kaizen is to change ways of thinking and way of production management. Underlying this theory, there is the gradual but constant improvement of the status quo with the active involvement of every management employee and the rest of the company workers. Kaizen educates employees towards finding ways to better perform their duties. Performance of work is closely connected with the observance of standards and the introduction of small improvements in order to continue its improvement.**

**Keywords:** Kaizen, quality, improvement

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Paper number: M201101

Manuscript of the paper received in 2011-09-20. Final paper including reviews reminders respect received to editors in 2011-11-11. The reviewers of this paper: Assoc. Prof. Miroslav Manas, MSc., Ph.D. and Assoc. Prof. Gejza Horvath, MSc., Ph.D.

## Fatigue life and surface integrity measurements of EN S355J2 steel used in hydraulic components

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**This article is aimed at studying the impact of surface integrity – surface roughness, hardness and residual stress – on fatigue performance of EN S355J2 steel. The test specimens were manufactured by turning. A longer fatigue life for the machined components can be obtained by applying such cutting conditions as a low feed rate. The fatigue limit of the specimen with the surface roughness Ra 1,6 µm is approximately 7 % higher than that of the specimen with Ra 3,2 µm. From the residual stress results it can be seen that the cutting conditions used for producing surface finish Ra 1,6 µm will introduce mainly compressive residual stress whereas the cutting conditions used for producing surface finish Ra 3,2 µm will introduce tensile residual stress. The measurements were carried out at Aalto University at the Departments of Engineering Design and Production and Material Science and Engineering in Espoo. The main purpose of the study is to find proper surface finishing techniques and fatigue improvements for hydraulic components.**

**Keywords:** fatigue life, roughness, hardness, residual stress, Wohler curve (S-N curve)

### Acknowledgements

*This paper relates to the work on the SGS research projects which are supported by the Ministry of Education of the Czech Republic. The fatigue tests and the surface integrity measurements were done under the auspices of the DEMAPP project organized by FIMECC Ltd. (Finnish Metals and Engineering Competence Cluster) and funded by TEKES (Finnish Funding Agency for Technology and Innovation) and private companies.*

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## Phase and structure characteristics of recycled AlZn10Si8Mg cast alloy

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The contribution describes effect of the temperature (20-400°C) on structure and mechanical properties (Brinell hardness and bending impact toughness) of the recycled AlZn10Si8Mg cast alloy. AlZn10Si8Mg cast alloy are used for engine and vehicle constructions, hydraulic unit and mould making without heat treatment. Improved mechanical properties are strongly dependent upon the morphologies, type and distribution of the phases, which are in turn a function of alloy composition and cooling rate. A combination different analytical techniques (light microscopy upon black-white and colour etching, scanning electron microscopy (SEM) upon deep etching, energy dispersive X-ray analysis (EDX) and HV 0.01 microhardness measurement) were therefore been used for the identification of the various phases. It is therefore necessary to study their structure and impact of intermetallic phases on the mechanical properties of aluminium alloys. The paper evaluates change of absorbed energy of impact at different temperature and the effect of structural change and hardness change in alloy during the test. The experiment was realized out using Charpy hammer and Brinell hardness tester.

**Keywords:** recycled aluminium cast alloy, SEM, intermetallic phases, Brinell hardness, bending impact toughness

### Acknowledgements

This work has been supported by Scientific Grant Agency of Ministry of Education of Slovak republic, No1/0841/11, KEGA 220-009ŽU-4/2010 and bilateral project SK-CZ-0086-09.

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Paper number: M201103

Manuscript of the paper received in 2011-08-01. Final paper including reviews received to editors in 2011-11-29. The reviewers of this paper: Prof. Iva Nová, MSc., Ph.D. and Assoc. Prof. Pavel Novak, MSc., Ph.D.

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## Analysis of influence of structure on mechanical properties of AlSiMg aluminium alloy processed by ECAP

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Microstructure and texture development of an AlSiMg alloy during equal channel angular pressing (ECAP) was investigated and correlated with the mechanical properties. The micro-structure was effectively refined by ECAP, and the original fibre texture of the extruded aluminium alloy was disintegrated and a new texture was gradually developed by repetitive ECAP pressing. After 6 ECAP passes following the route Bc, the yield stress was lower than that of the as-extruded aluminium alloy, indicating that the texture softening was dominant over the strengthening due to grain refinement. Cross-section of original samples was  $\phi$  12 mm and their length was 80 mm. Deformation forces were measured during extrusion, resistance to deformation was calculated and deformation speed was determined approximately. Analysis of structure was made with use of light microscopy, TEM and SEM. Mechanical properties of the samples after extrusion were determined by tensile test and by the so called penetration test.

**Keywords:** micro-structures, properties, aluminium alloy, ECAP

### Acknowledgements

The works were realised under support of the Czech Ministry of Education - project VS MSM 619 891 0013 and project GA Czech Republic No. 106/09/1598.

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Paper number: M201104

Manuscript of the paper received in 2011-10-21. Final paper including reviews received to editors in 2011-11-23. The reviewers of this paper: Assoc. Prof. Dalibor Vojtech, MSc., Ph.D. and Assoc. Prof. Jan Sanovec, MSc., Ph.D.

## Cavitation erosion resistance of the chosen aluminum alloys

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**The cavitation erosion is a process of material deterioration as a result of materialization, increase and decrease of the cavitation bubbles in different types of liquid. The cavitation erosion materials are used to prevent the devastating effect of imploding bubbles. The aluminum alloys are often used on the parts of machines exposed to cavitation erosion phenomenon. The following article brings up the study of the results of investigation cavitation erosion resistance aluminum alloys: EN AW-2017A, EN AW-5754 and EN AW-7075.**

**Keywords:** cavitation, cavitation erosion, aluminium alloys.

### Acknowledgements

*Scientific work funded by the Ministry of Education and Science in the years 2011 ÷ 2014 as a research project No. N N507 231 040.*

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Paper number: M201105

Manuscript of the paper received in 2011-07-30. Final paper including reviews received to editors in 2011-11-25. The reviewers of this paper: Prof. Ivan Lukac, MSc., PhD. and Assoc. Prof. Miroslav Müller, MSc., Ph.D.

## Application of magnetic correlation analysis on the choice and correction of cutting parameters for automated manufacturing systems

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The paper is focused on the optimization of cutting parameters and their correction using magnetic correlation kinetic analysis to determine the workability of the material machined. The integrity of the surface layers, dimension and shape accuracy and cost of production is primarily dependent on the input parameters of the cutting process with particular workpiece material and its workability, the required quality, working conditions, type of cutting tool, workpiece material and machine tool. Different homogeneity causing uneven machinability, its early detection and quantitative assessment before entering into the semi-machining process is an important factor to stabilize and optimize the cutting process, especially in automated manufacturing. The identification of variations in machinability of the desired state can use the principle magnetic correlation analysis of the material and the values used to control and optimize the cutting process. This principle can be applied to adaptive control of modal commands direct change in the control program.

**Keywords:** Magnetic correlation analysis, optimization, theory of cutting, cutting tools, kinetic machinability

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Paper number: M201106

Manuscript of the paper received in 2011-11-10. Final paper including reviews received to editors in 2011-12-14. The reviewers of this paper: Prof. Dr. h.c. Karol Vasilko, MSc., Sc.D. and Prof. Jan Madl, MSc., Ph.D.



## Alternative machining procedures of hardened steels

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**This paper outlines the hard machining procedures, their applicability, the increase of their efficiency and the possibilities provided through their combination. It focuses on the advantages of the cutting and grinding compared to each other and also on the cases when it is appropriate to apply them or possibly combine them.**

**Keywords:** grinding, hard turning, alternative machining, hardened steel

### Acknowledgement

*The work was presented by the support of the Hungarian Scientific Research Fund (Number of Agreement: OTKA K 78482 and OTKA 84177), which the authors greatly appreciate.*

*The described work was carried out as part of the TÁMOP-4.2.1.B-10/2/KONV-2010-0001 project.*

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Paper number: M201107

Manuscript of the paper received in 2011-06-21. Final paper including reviews received to editors in 2011-11-04. The reviewers of this paper: Prof. Dr. h.c. Karol Vasilko, MSc., Sc.D. and Prof. Jan Madl, MSc., Ph.D.

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## Microstructure and Mechanical Properties of the AlSi13Mg1CuNi Alloy With Ecological Modifier

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**A homogenous modifier obtained by the rapid solidification at a cooling rate equal to  $v=200$  K/s was applied to the modification of the AlSi13Mg1CuNi alloy. The different modifiers were obtained by means of the Al-Si alloys containing 0, 7 and 12 at. % Si, respectively. The components Al, Al-7Si, Al-12Si were put into crucible containing the liquid AlSi13Mg1CuNi alloy. Both, effect of cooling rate applied to obtain modifier and weight in weight modifier concentration in the melt on microstructure, tensile strength and hardness of AlSi13Mg1CuNi alloy are determined. A structural, physical and mechanical properties resulting from the AlSi13Mg1CuNi alloy treatment by modifiers are studied in details.**

Key words: Al-Si alloy, silumin, mechanical properties, ecological modification, homogenous modifier

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Paper number: M201108

Manuscript of the paper received in 2011-07-30. Final paper including reviews received to editors in 2011-11-28. The reviewers of this paper: Prof. Eva Tillova, MSc., PhD. and Prof. Iva Nova, MSc., Ph.D.

## Use Properties of the AlSi9Mg Alloy With Exothermic Modifier

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**The improvement in mechanical properties generally has been attributed to the morphology and size of the  $\alpha$ - and  $\beta$ -phase. Chemical elements and compounds, both added to the alloy and formed as a result of exothermic reactions, “pass” into the alloy, changing the course of its crystallization. Selection of the mixture components allows – to a degree – to decide about the starting moment of crystallization and change the range of solidification of alloy or its individual phases. Control over crystallization by acceleration or deceleration of the equilibrium process enables to affect the alloy structure. Another advantage may be addition of the desired components. Properly selected, they can influence crystallization and after alloy solidification – play an important role in its further use. This work presents results of modification of AlSi9Mg alloy with a modifier containing Na, F and Cl. The modifier was taken down with components: NaCl,  $\text{Na}_3\text{AlF}_6$  and NaF. The influence of the modifier in reference to the properties of the alloy on elongations, Brinell hardness, impact strength was introduced in a graphic method. The analysis of the modification process of eutectic alloy AlSi9Mg with a compound modifier showed the modifying influence on the studied properties of AlSi9Mg alloy.**

**Keywords:** Al-Si alloy, silumin, mechanical properties, metallurgy

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Paper number: M201109

Manuscript of the paper received in 2011-07-30. Final paper including reviews received to editors in 2011-11-28. The reviewers of this paper: Prof. Augustin Sladek, MSc., PhD. and Assoc. Prof. Pavel Novak, Ph.D.

## Unconventional machining method for enhancing the durability of tools and strength of the specimens bonded

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**The article presents the results from the application of a new method for raising the exploitation characteristics of metal-cutting tools, which includes preliminary combined magnetic field and ultrasound processing of the instrument. The indirect effect of the processing on the cutting force as well as on the roughness of the processed surface and on the wearing of the instruments during the drilling and milling processes has been studied. Demonstrated the effectiveness of the method on shear strength of the metal samples bonded**

**Key words:** magnetic-ultrasound, wear-resistance, dependent variables, shear strength

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Paper number: M201110

Manuscript of the paper received in 2011-06-21. Final paper including reviews received to editors in 2011-11-21. The reviewers of this paper: Assoc. Prof. Ivan Mrkvica, MSc., Ph.D. and Assoc. Prof. Libuse Sykorova, MSc., Ph.D.

## Surface quality of hardened steels after grinding

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**Problems about hardened steels grinding is presently very important part of engineering. Many applications of these materials using in practice, machine, devices and in different industry like automotive, aviation, cosmonautics and in area of health, safety and protection of passengers in vehicles, planes, aircrafts, ships, trains and many others. Because of these areas that used the passengers is very important surface quality and durability of these parts of machines. Topic of surface quality changes in working of the parts is especially important in dynamic load parts. These parts are very loaded by alternating stress in cases of double axis stress (torsion and bend). Such materials are for example bearing, shafts and gears. In all cases the production technology influences surface quality.**

**Keywords:** Cutting Conditions, Grinding, Microstructure, Residual Stress, Surface Quality

### Acknowledgement

*This experiment appears by means of specific research of J. E. Purkyne University deals with automotive parts machining.*

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Paper number: M201111

Manuscript of the paper received in 2011-10-20. Final paper including reviews reminders respect received to editors in 2011-11-11. The reviewers of this paper: Prof. Dr. h.c. Karol Vasilko, MSc., Sc.D. and Prof. Karel Kocman, MSc., Sc.D.

## Weldability problems of the technical AW7020 alloy

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**The article presents problems related to welding alloys of the 7000 series at an example of the AW 7020 grade alloy, by relating the obtained properties to their microstructure. Welded joints were performed with use of the weld metals according to the PN-EN ISO 18273:2007 Standard. The welded joints were subjected to evaluation of their modifiability by heat treatment.**

**Keywords:** aluminium alloys, 7000 series, AW7020, weldability, microstructure

### Acknowledgements

*The work co-financed from means of the Development Project No 03003906*

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Paper number: M201112

Manuscript of the paper received in 2011-07-30. Final paper including reviews reminders respect received to editors in 2011-11-22. The reviewers of this paper: Prof. Josef Mesko, MSc., PhD. and Assoc. Prof. Drahomir Schwarz, MSc., Ph.D.

## The impact of the cast-iron semi-finished product hardness on the surface quality after the machining process

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**This paper deals with the assessment of the impact of the semi-finished product hardness and the cutting conditions of machining process on the surface roughness of the workpiece after machining. The paper shows that the hardness of the material machined layer and also its inhomogeneity have an impact on the resultant quality of the machined surface. The appreciable impact on the surface quality has also the cutting conditions size affecting at the same time the machining temperature. The machining process took place in the company WIKOV MGI J.S.B. in Hronov on the machine Hedelius BC 100 with the face-milling cutter that was attached with the replaceable cutting tips made from the sintered carbide by the company KENNAMETAL. The machining material was a cast-iron.**

**Keywords:** surface roughness, hardness, machining

### Acknowledgement

*This paper is connected with the project resolution MSM 4674788501, supported by MŠMT ČR.*

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Paper number: M201113

Manuscript of the paper received in 2010-09-10. Final paper including reviews received to editors in 2011-12-21. The reviewers of this paper: Prof. Karel Kocman, MSc., Sc.D. and Prof. Jan Madl, MSc., Ph.D.



## Quality control of microstructure in recycled Al-Si cast alloys

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Using recycled aluminium cast alloys is profitable in many aspects. Secondary aluminium produced from recycled metal requires only 2.8 kWh/kg of metal produced and creates only about 5 % as much CO<sub>2</sub> as by primary production. Improved mechanical properties of recycled (secondary) hypoeutectic Al-Si cast alloys are strongly dependent upon the distribution and the shape of the silicon particles; the morphology, type and distribution of the second phases, which are in turn a function of alloy composition and cooling rate. The presence of additional elements as Mg, Mn, Fe, or Cu allows many complex intermetallic phases to form, which make characterisation non-trivial. They are added deliberately to improve and to provide special material properties. Controlling the microstructure is, therefore, very important. A combination of different analytical techniques (light microscopy upon black-white etching; scanning electron microscopy (SEM) upon deep etching and energy dispersive X-ray analysis (EDX); quantitative phase analyse upon Image analyzer NIS Elements 3.0) were therefore been used for the quality control of microstructure in recycled AlSi9Cu3 cast alloy.

**Keywords:** recycled Al-Si cast alloys, microstructure, intermetallic phases

### Acknowledgements

This work has been supported by Scientific Grant Agency of Ministry of Education of Slovak republic N<sup>o</sup>1/0249/09 and N<sup>o</sup>1/0841/11.

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Paper number: M201114

Manuscript of the paper received in 2011-08-01. Final paper including reviews reminders respect received to editors in 2011-11-16. The reviewers of this paper: Prof. Ivan Lukac, MSc., PhD. and Assoc. Prof. Dalibor Vojtech, MSc., Ph.D.

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## Identification of „natural“ breaker cut during the machining of carbon steels

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**Tool wear is generally considered a negative fact, which worsens machining results. According to theories it causes the growth of cutting forces, cutting temperature worsens the quality of machined surface. Closer study of the process of the wear leads to the need to distinguish between the effects of the wear on the back and on the face of the tool. The paper deals with the study of the mechanism of wear on the face in time relation. It shows that the groove on the face, which is created by leaving chip, can have positive aspect. It can be used as „natural chip shaper“.**

**Keywords:** cutting tool, tool wear, machining time, tool life

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Paper number: M201115

Manuscript of the paper recieved in 2011-03-28. Final paper including reviews reminders respect recieved to editors in 2011-12-15. The reviewers of this paper: Prof. Karel Kocman, MSc., Sc.D. and Prof. Frantisek Holesovsky, MSc., Ph.D.