# SUMMARIES


Stadnik R., Kazanecki J.:

**Investigation of Hydroforming of the Y-shape Branch**

Metallurgy and Foundry Engineering – Vol. 35, 2009, No. 1, pp. 13÷26

This paper describes FEM simulations and experiments of the hydroforming process, which were carried out using test stand and ABAQUS/CAE software. The application of simulation methods to the development of the hydroformed parts was illustrated. The influence of the forming conditions, such as the loading path of the hydraulic pressure and the axial feeding, on the hydroforming of Y-shapes was investigated. These estimated conditions were improved in FEM simulations and then verified with hydroforming experiment. A tube made of stainless and unalloyed steels were taken into consideration both in a numerical and experimental study. The experimental investigation shows considerable influence of the mechanical properties of the examined steel grades on the metal flow and final shape, especially the thickness distributions and the branch height. The results from the experiment and FEM simulation, e.g. loading path, thickness distributions or branch height were in good agreement. This means that numerical simulation is a good way to evaluate the part formability.



***Keywords:*** *hydroforming, loading path, Y-shape branch*



Sińczak J., Chyła P., Bednarek S., Łukaszek-Sołek A., Skubisz P.:

**Lubrication Conditions Influence on the Filling Process of Die Impresion in Complex Forging Extrusion of A95456 Alloy**

Metallurgy and Foundry Engineering – Vol. 35, 2009, No. 1, pp. 27÷34

In the paper was analysed the rheology of metal flow in complex die forging process with closed-die with domination of direct and indirect extrusion beside different lubrication conditions on the die impression. It was found that apply of suitably diversified lubrication conditions brings favourable effect in form of decrease of the deformation energy and simultaneously favourable influence on the uniform deformation in whole volume of the forging.



***Keywords:*** *A95456 alloy, complex extrusion process, lubrication, effective strain, vectors of the metal displacement*



Rutkowska-Gorczyca M., Podrez-Radziszewska M., Kajtoch J.:

**Corrosion Resistance and Microstructure of Steel AISI 316L after Cold Plastic Deformation**

Metallurgy and Foundry Engineering – Vol. 35, 2009, No. 1, pp. 35÷43

In the paper, results of microstructure and hardness examination of cold-worked alloyed steel AISI 316L are presented. In addition, determined was corrosion resistance of the steel in the Ringer

solution. Corrosion tests were performed after cold working with 10, 20, 30, 40 and 50% ratio. Potentiodynamic tests included recording polarisation curves as well as determining corrosive potential and corrosive current for various cold working ratios. Cross-sections of the specimens after corrosion tests were observed and analysed using a scanning microscope.

***Keywords:*** *corrosion resistance, austenitic steel, cold working*

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Krawczyk J., Pawłowski B., Bała P.:

## Banded Microstructure in Forged 18CrNiMo7-6 Steel

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18CrNiMo7-6 steel, after hot forging, exhibits a distinct banding of ferritic-pearlitic microstructure, probably related to the segregation of alloying elements during the ingot crystallization. The heat treatment allowing to obtain bainitic microstructure in this steel is described in the paper. The obtained bainitic microstructure exhibits only very small traces of banding.

***Keywords:*** *hot forging, toothed wheels, banded microstructure in ferritic-pearlitic steel, heat treatment*

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Czarski A.:

## Analysis of Clements' Method for Capability Indices Estimation

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Statistical methods belong to the basic quality tools. Among statistical instruments the statistical process control SPC takes particular place. One of the principal tasks of SPC is process capability analysis i.e. the assessment of process potential as for variability regarding expectations defined by specification limits. This work concerns the comparative analysis of capability indices determination in case of distribution unlike the normal one.

***Keywords:*** *statistical process control (SPC), process capability analysis, non-normal distributions, Clements' method*

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Hutera B.:

## Mechanical Properties of Modified Binders vs. Sand Strength

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The study describes investigations of the stress $\sigma$ in function of a relative displacement $\varepsilon$ for the modified and non-modified epoxy binders.It has been stated that an addition of the modifier affects the run of function $\sigma = f(\varepsilon)$ and the value of a breaking stress. Small additions of the modifier (or its total absence) give the function typical of brittle materials, while large additions of the modifier result in an opposite situation, which means that the function is running in a mode typical of plastic bodies with an obvious elongation of the specimen. The results obtained for different runs of function $\sigma = f(\varepsilon)$ and for different values of the breaking stresses resulting there from were verified on sands hardened with epoxy binder.

***Keywords:*** *epoxy binder, mechanical properties, strenght of moulding sands*