

## FOUNDRY INDUSTRY – CURRENT STATE AND FUTURE DEVELOPMENT

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The casting production is considered as one of the main factors influencing the development of world economy. The state of art and foresight of world's casting production is discussed in the paper on the basis of the latest statistical data. The progress gained during the last few years in foundry engineering is shown as a way to further development of foundry technology. The last decade brought significant changes in the world map of the greatest casting producers. Globalization and transformation of economic systems is reflected by variations of foundry production in different countries, more over the globalization of economy is regarded not only as a chance but also as a menace for the European foundries.

*Key words:* foundry, casting, production, development.

**Ljevačka industrija – sadašnje stanje i budući razvitak.** Ljevačka proizvodnja se smatra jednom od glavnih utjecajnih faktora u svjetskom gospodarstvu. Stanje postignuća i predmnijevanje ljevačke proizvodnje na temelju posljednjih statističkih podataka daje se u ovom članku. Polučeni napredak tijekom nekoliko posljednjih godina u ljevačkoj tehnici je prikazan kao putokaz budućeg razvitka ljevačke tehnologije. Posljednja dekada donosi značajne izmjene na svjetskoj karti najvećih proizvođača odljevaka. Globalizacija i transformacija ekonomskog sustava održavanja se raznolikošću u ljevačkoj proizvodnji različitih država, što više globalizacije gospodarstvo se motri ne samo kao šansa nego i kao ugroz europskih ljevaonica.

*Ključne riječi:* ljevarstvo, odljevak, proizvodnja, razvitak

### INTRODUCTION

The casting production is considered of the main factors influencing the development of World economy. Actual capacity of the world's casting production, which is higher than 91 mln metric tons per year (2010), is strongly diversified. The last decade brought significant changes in the World map of the greatest casting producers. Globalization and transformation of economic systems is reflected by variations of foundry production in different countries, moreover the globalization of economy is regarded not only as a chance but also as a menace for the European foundries [1].

### ESTIMATION OF THE CURRENT SITUATION IN THE WORLD'S CASTING PRODUCTION

A casting production in the last years has had an increasing tendency. It is shown by the fact, that the world casting production increased by 13,7 % from 2009 to 2010. However, the total casting production being 91,4 million tons in 2010, was still lower than the production in 2008 being 93,5 million tons and than the peak year 2007 when the casting production equaled 94,9 million tons.

Out of 36 countries, main casting producers in the world, in 4 countries only the casting production in 2010 was lower than in 2009 (Canada, Norway, Serbia and Slovenia). Whereas Taiwan and Brazil had the highest production increase in this period, being 42 % and 41 %, respectively.

10 countries, the largest casting producers in the world produced in 2010 approximately 88 % of casting, having the same participation in the global production as in 2009. The largest casting producers in the year 2010 were: China, India, USA, Germany, Russia, Brazil, South Korea, Italy and France (Figure 1, Table 1).

Casting production in the EU countries in 2010 is shown in Figure 2.

The leader in the casting production from many years is China, which produced 43 % of castings in 2010. The second place, however with the production 4-times smaller than China, belongs to India, which share is 10 %, due to 22 % increase in relation to 2009. A significant production increase (11 % as compared with 2009) obtained also the United States of America. The EU countries share in the casting production equaled approximately 15 % (Figure 3) [2-4].

The highest fraction constitute gray iron castings, which tonnage in 2010 was 44,1 million tons, it means above 48 %. Castings of the spheroidal cast iron constituted nearly 25 % and increased by 1% in relation to

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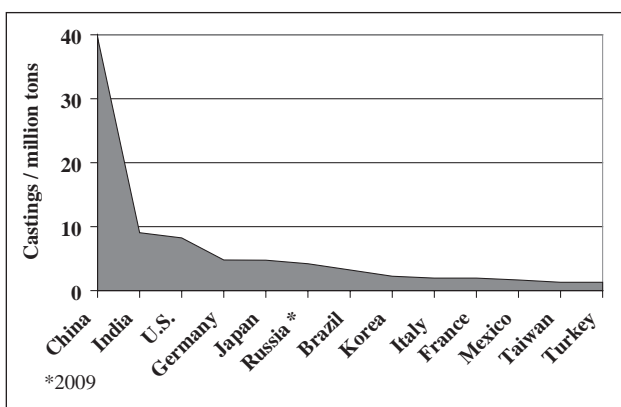


Figure 1 Castings production in the leading world countries in 2010 [2]

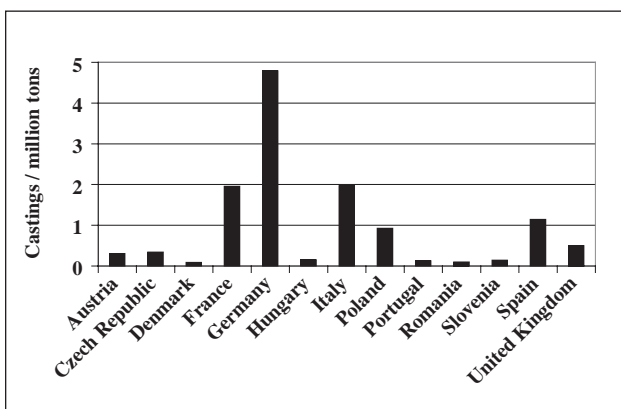


Figure 2 Casting production in the EU countries in 2010 [2, 3]

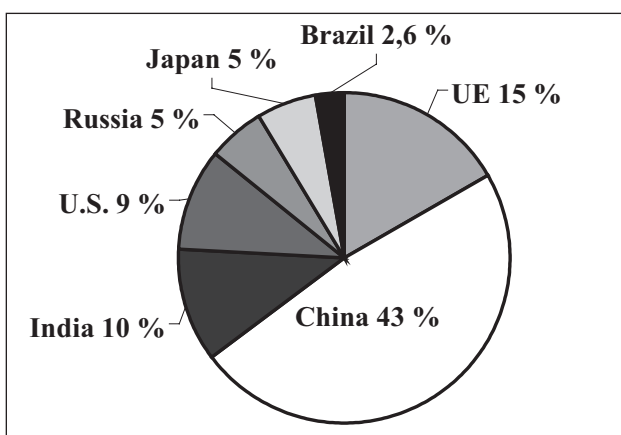


Figure 3 Leading countries share in the world castings production [2-4]

2009. Whereas the share of steel casts equaled approximately 11 % and was slowly decreasing during the year 2010, in a similar fashion as the non-ferrous metals castings, which equaled approximately 16 % in 2010 (Figure 4). Among the non-ferrous metals castings the dominating position was taken by the aluminium alloy castings (approximately 11 % of the total world casting production). The share of magnesium, zinc, copper and other non-ferrous metals was very small.

Casting production value of 10 largest producers – with indicating the kind of material – in the year 2010 are shown in Table 1.

Tendencies in the global production of castings with indicating the kind of material (in years 2001-2010) are

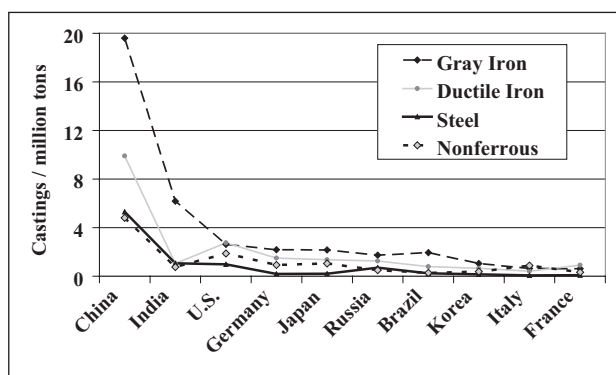


Figure 4 Fraction of individual casting materials in the world production in the year 2010 [2]

Table 1 Casting production in countries being the largest producers, showing fractions of various materials used [2]

Country	Gray Iron	Ductile Iron	Steel	Nonferrous	$\Sigma$
	Castings / thousand tons				
China	19 600	9 900	5 300	4 800	39 600
India	6 180	1 050	1 070	750	9 050
U.S.	2 630	2 750	980	1 870	8 230
Germany	2 180	1 490	192	930	4 792
Japan	2 160	1 350	207	1 040	4 757
Russia	1 740	1 260	700	500	4 200
Brazil	1 940	786	243	273	3 242
Korea	1 040	653	157	382	2 232
Italy	630	405	64	870	1 969
France	623	916	85	333	1 957

presented in Figure 5, while for the selected largest casting producers – in Figure 6 a, b. It is worth to notice that the crisis of the year 2009 influenced the China casting production very favourably, and in a certain degree also India, while the remaining countries reported the production decrease.

The total number of foundry plants in the world amounts to more than 48 000, out of which nearly 55 % are located in China. The second place in respect of the foundry plants number belongs to India, where there is more than 9 % foundry plants. The most of them are

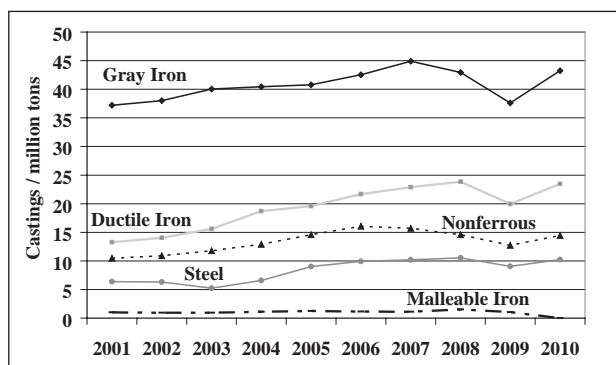


Figure 5 Casting production in the years 2001 – 2010, showing fractions of various kinds of material used [5]. Notice: It is expected that in 2011 production of ferrous alloy castings was 78 million tons, aluminium alloy castings approximately 13 million tons, and copper alloy castings 1,6 million tons [6].

producing iron castings (50 %). An average annual production of one foundry plant equals in China 1 500 tons, in India app. 2 000 tons, while in Japan nearly 3 000 tons, in the USA – 4 000 tons, and in Germany – the clear leader in productivity – above 7 800 tons. This indicates that the foundry industry is highly fragmented in the first two countries, which at the same time are the largest casting producers [7].

The foundry industry is predominantly still an SME industry, with 80 % of companies employing less than 250 people. The foundry production which is now undertaken results from fewer units and less employees. This can be explained by progressive up scaling and automation in the foundry units. The relationship between unit size, production and employments is well illustrated in Figure 7 (ferrous foundry) and Figure 8 (nonferrous foundry).

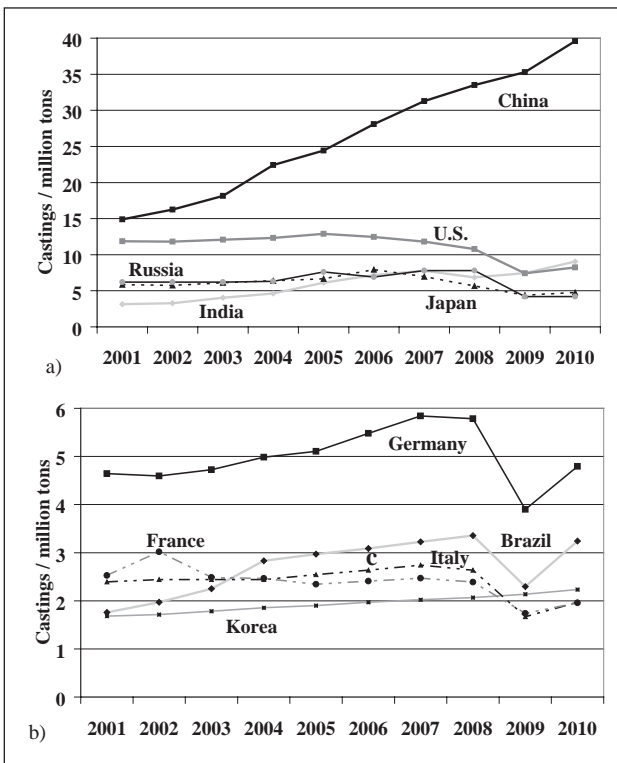


Figure 6 Total casting production in 10 countries, being the leaders, in the period: 2001 – 2010 [5]

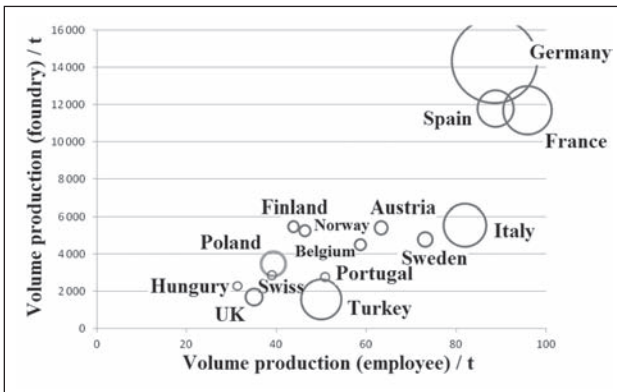


Figure 7 Ferrous foundry productivity data for various European countries. Notice: the size of the circle represents the total production in the specified country [2-4]

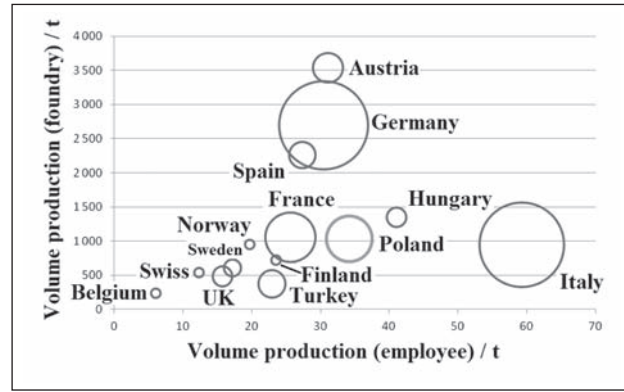


Figure 8 Non ferrous foundry productivity data for various European countries. Notice: the size of the circle represents the total production in the specified country [2-4]

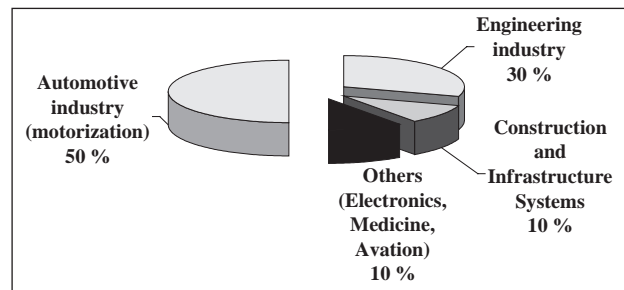


Figure 9 Main markets served by the foundry industry

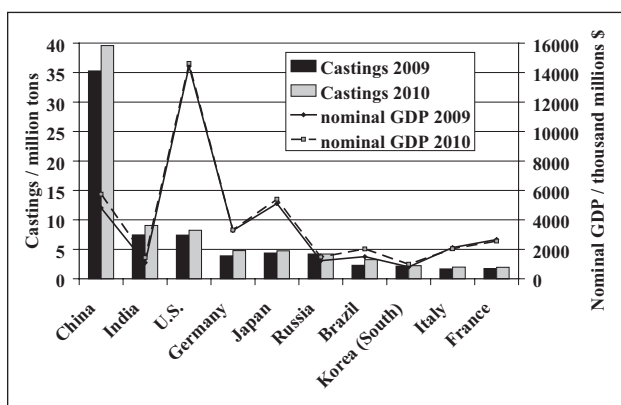
The comparison of the production effectiveness in the European countries in years 2009 and 2010 indicates an increase. Within the ferrous alloy castings the production effectiveness is the highest in Germany, France and Spain. Whereas within the domain of the non-ferrous metals castings the sequence is as follows: Austria, Germany, Spain.

The main markets served by the foundry industry are the automotive, general engineering and construction sectors (Figure 9).

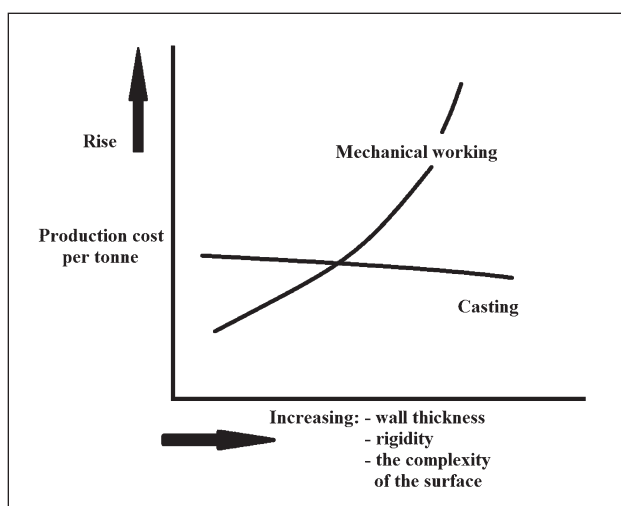
### IS THE FOUNDRY INDUSTRY AS THE PRODUCTION TECHNIQUE HAVING FUTURE?

Analysis of the world economy and its development trends indicates for the constantly growing share of foundry industry as the production and treatment technology of metal products. The biggest growth of casting production takes place in the countries being the economic leaders, in which it constitutes the significant part of the global income (Figure 10).

Continuous development of technologies and means of production did not cause any elimination of casting as a production techniques, but – on the contrary – increased its importance and resulted in treating the foundry industry as a significant and constant element of economic and civilization development of nations. Direct shaping of metal products of practically every degree of complication, realized by the limited number of technological procedures, eliminating several additional operations – necessary when other production tech-



**Figure 10** Gross domestic product (GDP) and the castings production in 2009 and 2010 in countries being the leaders in the casting production



**Figure 11** Comparison of the production costs of the product obtained by means of the casting technology and mechanical treatment technology [8]

niques are employed – constitutes still the basic and advantage of this method, even when castings are in the range of the so-called “high-tech” (Figures 11, 12).

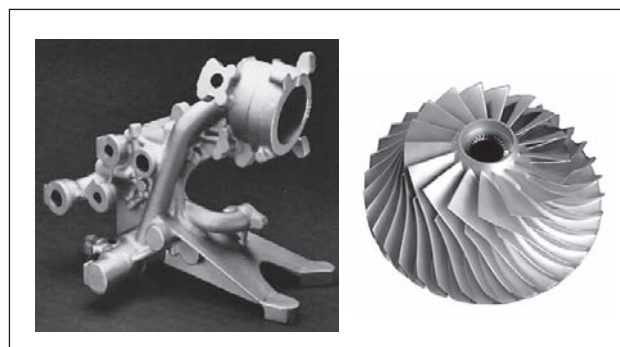
## CHANCE AND DIRECTIONS OF THE FOUNDRY INDUSTRY FURTHER DEVELOPMENT

The most important research directions leading to further development of the foundry industry:

- development of new technologies and casting alloys,
- melting and liquid metal preparation,
- manufacturing of moulds and cores,
- preparation of casting materials and composites,
- pouring, solidifying and cooling of casting,
- technological waste management,
- new production systems and quality control,
- sustainable development of foundry industry,
- energy and material efficient technologies.

## CONCLUSIONS

European metalcasting industry, just as most European and USA manufacturing, suffered greatly from the early in this decade. Moreover, substantial dynamics in the global economy, especially off-shore sourcing of cast



**Figure 12** Examples of castings made with the application of the most modern casting technologies

metal components as well as the off-shore manufacturing of durable goods that require castings continue to profoundly reshape European metal casting industry. The effects of the recession were magnified by the influx of low-priced castings from off-shore sources including Brazil, India and particularly China. Nowadays it is becoming clear that economic trends and technological advances are creating an inflection point in the growth rate for cast metals components. The growth in the world economy, particularly in such countries like: China, Russia, India and Brazil will fuel demand for casting related to transportation and an industrialized infrastructure.

Metalcasters need to invest in technology and in people. A meaningful improvements in casting design, modeling, prototyping and production will be of the highest importance if foundries want to achieve increasing the capabilities and lower costs.

Finally foundries need to invest in people. The knowledge and skills needed to keep pace are changing even faster than the technology. Over the next 50 years, new skills will need to be developed every three to five years. Ongoing training and education will be a must for successful foundries.

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**Note:** The responsible translator for English language: “ANGOS” Translation Office, Kraków, Poland