

THE STATE OF ART AND FORESIGHT OF WORLD'S CASTING PRODUCTION

Received – Priljeno: 2014-02-05

Accepted – Prihvaćeno: 2014-05-30

Review Paper – Pregledni rad

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 about 101 mln metric ton per year (2012), 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 European foundries.

Key words: foundry, casting production, development, economy

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

There has been a growth trend in the casting production during the last years. This is shown by the fact that the world casting production increased 2,3 % from the year 2011 to 2012 and 6 % from 2008 (the year before production totals were significantly impacted by the economic down turn) to 2012. Global production continues to exceed prerecession levels. The three largest casting producers in the world provided the most growth in the past four years, with China, U.S and India improving output by nearly 14 million metric tons. Out of the largest world castings producers, such countries as Brazil and Japan did not achieve in the year 2012 the production level of the year 2008. Brazil revealed the largest production drop as compared to the year 2008 (in 2008 the casting production was equal 3,2 mln tons, while in 2012 only 2,9 mln tons, i.e. app. 11 % less). Germany, France and Italy were the European countries, in which the casting production in the year 2012 was significantly lower than before the recession. Whereas Poland, Ukraine, Slovakia and Hungary exceeded the casting production level from the year 2008 [1].

10 countries, being the largest casting producers in the world, produced in 2012 approximately 88 % of castings, which is likewise as in three previous years. The largest casting producers in the world were China (42,500 mln tons in 2012), U.S. (12,825 mln tons), India (9,344 mln tons), Germany (5,214 mln tons), Russia (4,300 mln tons), Brazil (2,860 mln tons), Korea (2,436 mln tons), Italy (2,960 mln tons) and France (1,800 mln tons) (Figure 1).

Total production of iron increased, with gray iron growing 0,3 % and ductile iron 1,6 %, while malleable iron fell 7,7 %. Steel improved 9,2 %, aluminum 6,5 % and magnesium 24,6 % [1 – 3].

The casting production in the EU countries in the year 2012 is presented in Figure 2.

Approximately 11,683 million tons of castings, which constituted 11,6 % of the world production were pro-

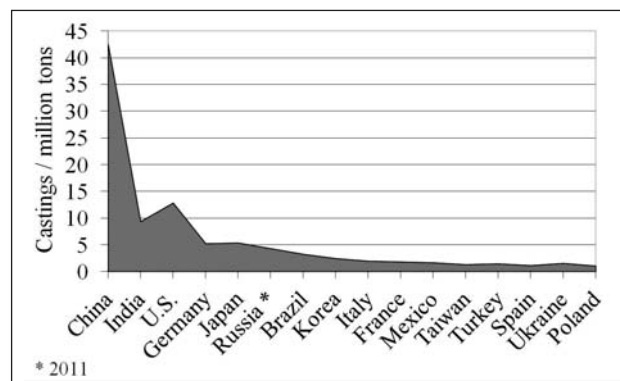


Figure 1 Castings production in the leading world countries in 2012 [3]

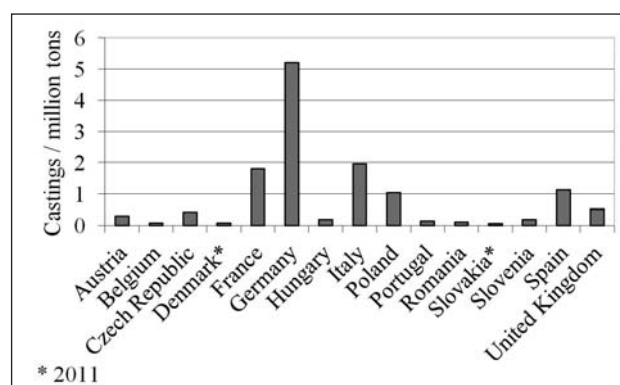


Figure 2 Castings production in the EU countries in 2012 [3]

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duced in the EU countries (Figure 3). Europe's total production dropped by half million ton, while North America, boosted by the U.S., is up 1,2 mln tons from 2011 levels. China also improved up 3 % since 2011 [2].

Castings of grey cast iron constituted the largest fraction of the total casting production (46 million tons, i.e. app. 46 %). The fractions of ductile iron increased slightly from 2011 levels, remaining at one quarter of total production. Steel and nonferrous castings also increased.

Steel castings constituted approximately 11 %, while non-ferrous metal castings 17 % (Figure 4). Out of non-ferrous metal castings aluminium alloys castings were dominating (app. 14 % of the total world casting production). The fractions of castings of magnesium, zinc, copper and other non-ferrous metals alloys were negligible.

Countries such as: Austria, Denmark, Finland, France, Norway, Portugal, Slovakia, Spain, Switzerland, the U.K. and the U.S. produce a more ductile iron than gray iron.

The casting production values of 10 largest producers, showing the kind of material, are presented in Table 1 (year: 2012).

Trends in the global casting production, together with their division into kinds of material, in the years 2002 – 2012, are presented in Figure 5, while for the selected largest producers in Figure 6. It is worth to no-

Table 1 Casting production in countries being the largest producers, showing fractions of various materials used in 2012 [3]

Country	Gray Iron	Ductile Iron	Steel	Non-ferrous
	Castings / 1000 t			
China	20 100	10 900	5 400	5 500
U.S.	6 254	981	1 158	891
India	4 296	4 480	1 433	2 531
Japan	2 393	1 642	217	931
Germany	2 210	1 377	213	1 506
Russia	1 858	898	731	473
Brazil	1 656	685	252	247
Korea	1 063	672	161	526
Italy	626	417	72	844
France	658	676	102	365

tice, that the year 2009 crisis influenced favourably the casting production in China and – to a certain degree – also in India, while in the remaining countries the production decreased.

The number of all foundry plants in the world equals nearly 51 000, out of which approximately 60 % are in China. The second place, in respect of the foundry plants number, belongs to India, where are 9 % of foundry plants. The largest number of foundry plants is producing castings of grey cast iron (46 %). The annual average production of 1 foundry plant in China is less than 1 500 tons, in India app. 2 000 tons, while in Japan 2 500 tons, in the USA – 6 400 tons (an increase of 26 % in relation to the year 2011), and in Germany – 8 500 tons (a decrease of 3,5 % in relation to the year 2011). This shows a significant fragmentation of the foundry industry in the first two countries, especially in China, which is – at the same time – the largest producer of castings.

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 (non-ferrous foundry) [4, 5].

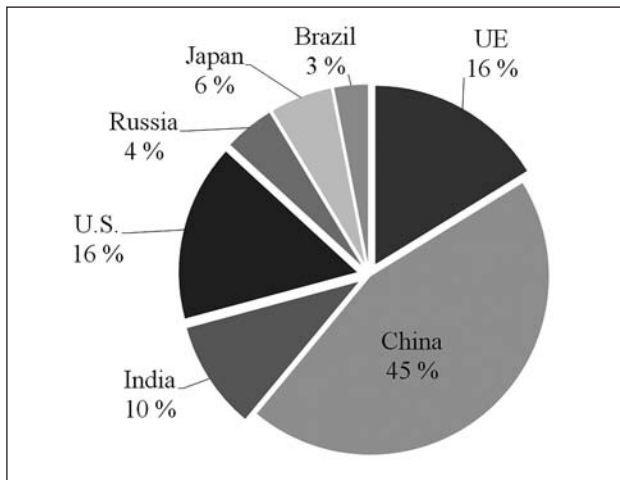


Figure 3 Leading countries share in the world castings production in 2012 [3]

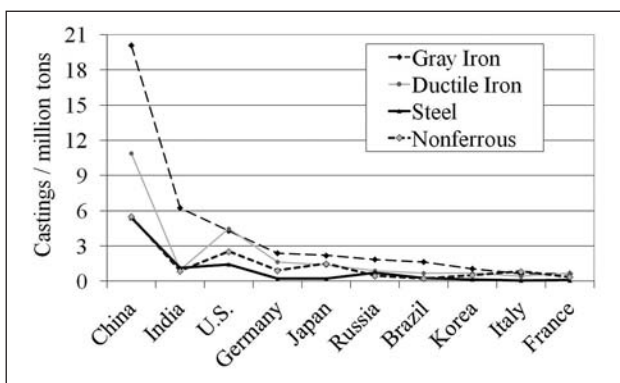


Figure 4 Fraction of individual casting materials in the countries being the largest producers in 2012 [3]

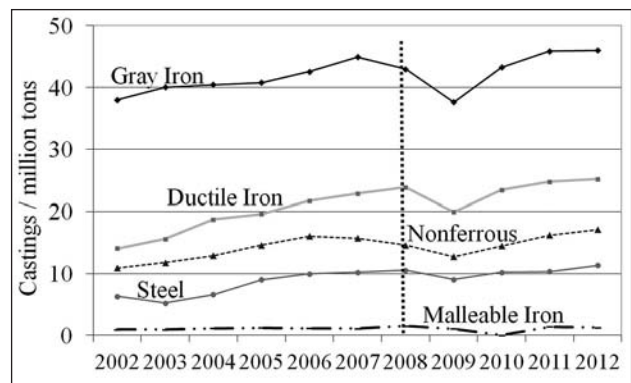


Figure 5 Casting production in the years 2002 – 2012, showing fractions of various kinds of material used [2, 3]

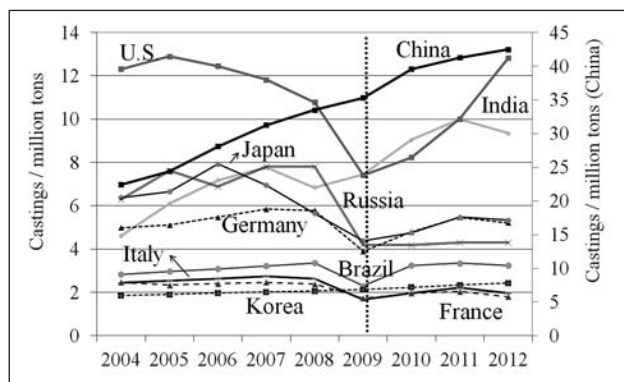


Figure 6 Total casting production in 10 countries, being the leaders, in the period: 2004 – 2012 [2, 3]

Employment in the foundry industry in the European countries dropped by 8 % in the year 2012 in relation to 2011, however it was by 6 % higher than in the year 2009 (Table 2).

In the majority of the European countries the casting production value in the year 2012 was lower than in 2011 (Table 3). Only Turkey achieved a significant increase of the production value of castings of non-ferrous metals alloys (by 32,4 % in relation to the year 2011) and a small one in castings of ferrous alloys (by 0,9 %). The remaining European countries (out of those which supplied their data) showed a decrease, sometimes significant, of the castings value produced in the year 2012 in relation to the year 2011.

Table 2 Employment in the foundry industry in the European countries [2 – 4]

Country	2011	2012	2012:2011, %
Austria	7 023	7 085	0,88
Belgium	1 688	1 650	- 2,25
Czech Rep.	18 000	-	-
Denmark	1 358	-	-
Finland	2 371	2 332	- 1,64
France	29 338	28 529	- 2,76
Germany	77 953	78 123	0,22
Hungary	5 500	5 120	- 6,91
Italy	28 700	28 096	- 2,10
Norway	1 720	1 485	- 13,66
Portugal	2 386	3 235	35,58
Slovenia	3 977	4 257	7,04
Spain	16 401	15 646	- 4,60
Sweden	6 350	6 200	- 2,36
Turkey	30 650	33 180	0,88
United Kingdom	20 500	18 500	- 2,25

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 of moulding sands – limitation of organic binders, and implementation inorganic binders, more friendly for environment and workers;

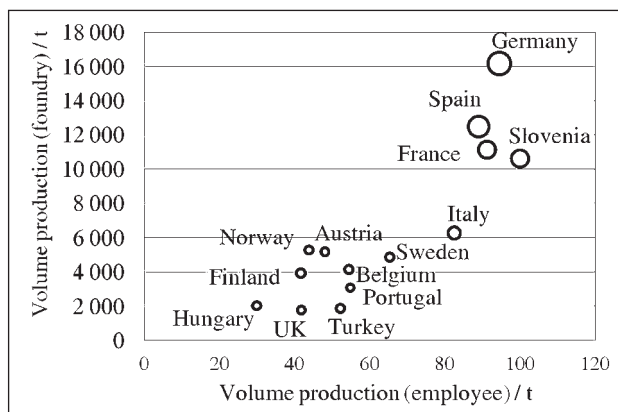


Figure 7 Ferrous foundry productivity data for various European countries in 2012 [3, 4, 6]

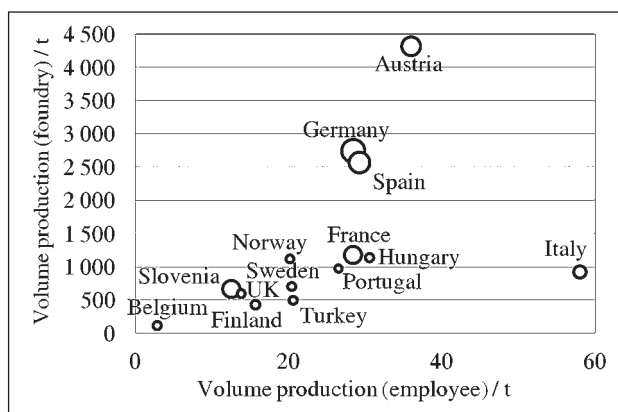


Figure 8 Non-ferrous foundry productivity data for various European countries in 2012 [3, 4, 6]

Table 3 Production value of castings in European countries (in Mio. €) [2 – 4]

Country	2011	2012	2012:2011, %
Austria	1 356,4	1 332,6	- 1,75
Finland	304,9	287,4	- 5,74
France	6 152	5 758	- 6,40
Germany	13 651	12 935	- 5,25
Hungary	320	216	- 32,50
Italy	0	6 750	-
Norway	264	232	- 12,12
Portugal	527,9	495,8	- 6,08
Spain	778,4	2 558	228,62
Turkey	2 433,5	2 669	9,68

- development of new casting alloys and casting composites with high properties for special using (renewable energy, nuclear energy, aviation);
- energy and material efficient technologies melting and liquid metal preparation;
- energy and material efficient technologies manufacturing of moulds and cores;
- better control of pouring, solidifying and cooling processes – utilization of simulation programs;
- technological waste management – prevention of generate of dangerous waste and limitation other waste;
- management of waste heat from foundry processes;

- new production systems and quality control;
- sustainable development of foundry industry.

Another sector, very important from the point of view of the development of the world casting industry, is the pressure die casting sector especially concerning structural castings for the automotive industry. The development of these types of castings is related to continuously tightening standards concerning CO₂ emission from passenger cars, and in consequence to the necessity of their weight decrease [7 – 9].

Metalcasters need to invest in technology and in people. A meaningful improvements in casting design, modeling, prototyping, binders, a energy and material efficient technologies and yield of production will be of the highest importance if foundries want to achieve increasing the capabilities and lower costs [10, 11].

Acknowledgements

The study was performed within the Project from Ministry of Science and Higher Education No. 11.11.170.318.

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Note: The responsible translator for English language: "ANGOS" Translation Office, Krakow, Poland.