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Trends in the Production of Castings in the World and in Poland in the XXI Century

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Abstract

The paper presents data concerning the total production of castings over the 2000-2014 period, both on a global scale, and in Poland. The basic types of casting alloys were taken into account. Changes in the production volume and structure over the period of the analysed 15 years were pointed out with respect to countries leading in foundry production. The topmost position in the world foundry industry is held by China for several years (with almost 45% share in the foundry market), the second place is taken by India (with almost 9% share). A distinct reduction in the shares of the once significant producers of castings, such as USA, Japan, Germany, Russia, Italy, or France, was observed over the 2000-2014 period. Poland had a share of 1.16% in 2000, and of 1.02% in 2014. Comparing the detailed data concerning the years 2000 and 2014, one can see that the fractions of castings made of ductile iron, cast steel, aluminium alloys, or magnesium alloys increase on a global scale, while such alloys as grey cast iron or malleable are in decline.

Keywords: Foundry production, Cast iron, Cast steel, Aluminium alloys, Non-ferrous alloys

1. Introduction

Castings are produced for many thousand years [1]. Metals and alloys used for their production, as well as casting technologies, changed over the time, but cast items invariably accompanied man and had to meet his consistently growing demands. Therefore the production of castings plays an important part both in the global and in the national economy. Nowadays the main recipient of the foundry production is the automotive industry, but castings find application also in other branches of industry, in civil engineering, in farming, in medicine, and can as well serve as art products.

The global foundry production volume, along with the structure of production with respect to the types of applied alloys reported in countries taking the leading positions on the foundry market, both considered over some longer period of time, make possible to determine current trends in the foundry industry. The presented analyses allow to find the world regions (continents) or countries where the production of casting gains in importance (and to the which extent), as well as where the opposite direction is followed. It can also be found what changes take place in the foundry production structure, i.e. which types of the casting alloys are more and more appreciated by customers.

The data concerning both the production volume and trends with respect to the production of castings in the world, in selected countries, and in Poland (up to the year 2013) were presented in some papers [e.g. 2-4]. It seems interesting to include in the analyses also the most recent available data from the year 2014. It was also considered as reasonable to assume the data from the year 2000, the end of the previous millennium, as a baseline for further comparisons. The analyses are possible thanks to data published every year by 'Modern Casting'; the present paper takes into account the data compiled in [5-19].

2. Production of castings over the 2000-2014 period

The world foundry market exhibited a distinct upward trend over the 2000-2014 period, however not entirely free of collapse: it occurred in 2008-2009. The global production of castings was about 64.75 million tonnes in 2000 [5], while it reached the level of about 103.64 million tonnes by the year 2014 [19] (an increase by about 60%). The production of castings in Poland over the same period of time increased from about 0.75 million tonnes to about 1.06 million tonnes (an increase by over 40%) [5, 19].

Table 1 compares the production of castings in the world and in several countries leading in this production, also in Poland, in years 2000 and 2014. This table compares also the shares of the individual countries in global foundry production in these years.

The structure of the foundry production in years 2000 and 2014 with respect to continents is presented in Figure 1.

Table 1.
Total production of castings in the world and in several leading countries along with their shares in the global foundry production [5, 19]

Country	Production in tonnes		Share in the global production		Average annual rate of changes in total production over the 2000-2014 period
	2000	2014	2000	2014	
China	10 954 629	46 200 000	16.92%	44.58%	**10.83%**
USA	13 129 200	10 470 939	20.28%	10.10%	**-1.60%**
India	3 120 000	10 021 000	4.82%	9.67%	**8.69%**
Japan	6 276 320	5 538 037	9.69%	5.34%	**-0.89%**
Germany	4 542 010	5 246 557	7.01%	5.06%	**1.04%**
Russia	6 200 000	4 200 000	9.58%	4.05%	**-2.74%**
Brazil	1 810 000	2 737 200	2.80%	2.64%	**3.00%**
Korea	1 651 300	2 630 900	2.55%	2.54%	**3.38%**
Italy	2 424 903	2 024 851	3.75%	1.95%	**-1.28%**
Turkey	965 000	1 750 000	1.49%	1.69%	**4.34%**
France	2 665 192	1 729 405	4.12%	1.67%	**-3.04%**
Mexico	1 761 000	1 651 679	2.72%	1.59%	**-0.46%**
Ukraine	947 239	1 560 000	1.46%	1.51%	**3.63%**
Poland	753 600	1 058 300	1.16%	1.02%	**2.46%**
World in total	**64 750 239**	**103 641 518**			**3.42%**

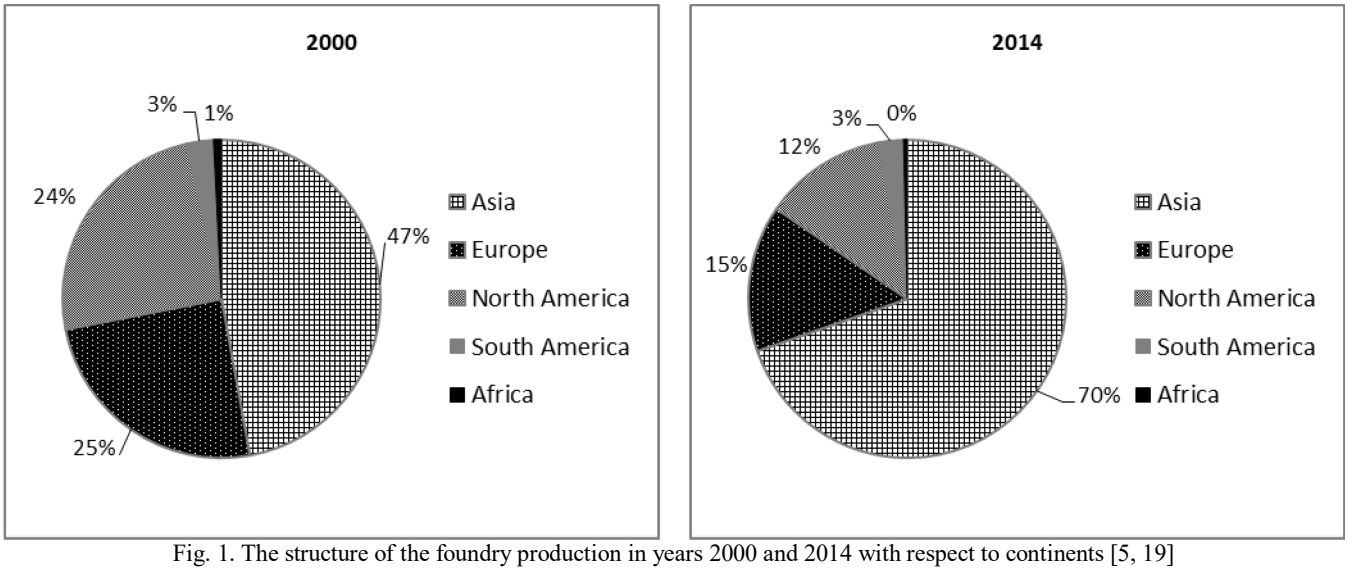

Fig. 1. The structure of the foundry production in years 2000 and 2014 with respect to continents [5, 19]

The data presented in Figs. 2 and 3 illustrate the foundry production volume and structure in the world and in Poland, respectively, over the considered period of time. As far as the global production of casting is concerned, the analysed fifteen-year-long period can be subdivided in three shorter periods (see Fig. 2):

– an increase in the production volume over the years 2000-2007 by about 46% (from about 64.75 million tonnes in 2000 to about 94.92 million tonnes in 2007) [4-11];
– a decrease in the production volume in 2008 and 2009 by about 15% (from about 94.92 million tonnes in 2007 to about 80.34 million tonnes in 2009) [12-13];
– an increase in the production volume over the years 2010-2014 by about 29% (from about 80.34 million tonnes in 2009 to about 103.64 million tonnes in 2014 [14-18].

It seems that four periods can be distinguished with respect to the production of casting in Poland over the past fifteen years (see Fig. 3):

– an increase in the production volume over the years 2000-2008 by about 25% (from about 754 thousand tonnes in 2000 to about 0.94 million tonnes in 2008);
– a decrease in the production volume over the years 2008-2009 by about 18% (from about 0.94 million tonnes in 2008 to about 0.77 million tonnes in 2009);
– an increase in the production volume over the years 2010-2013 by about 65% (from about 0.77 million tonnes in 2009 to about 1.27 million tonnes in 2013);
– a drop reported in 2014 (as compared with 2013) by about 16%, i.e. from the level of 1.27 million tonnes to the value of 1.06 million tonnes.

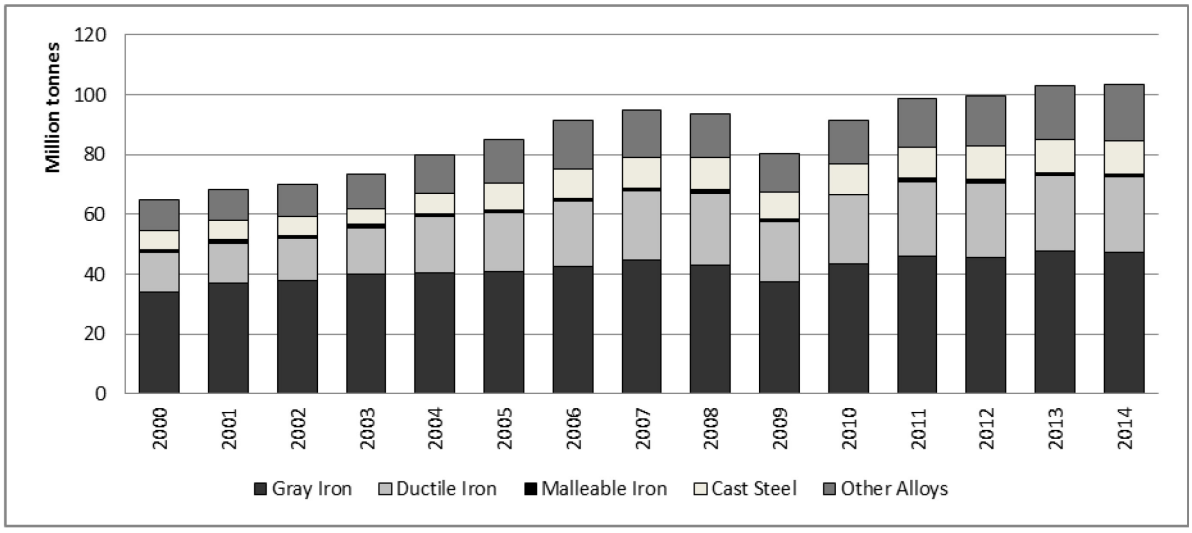

Fig. 2. Global production of castings over the years 2000-2014 and the fractions of basic cast alloys in the production volume [5-19]

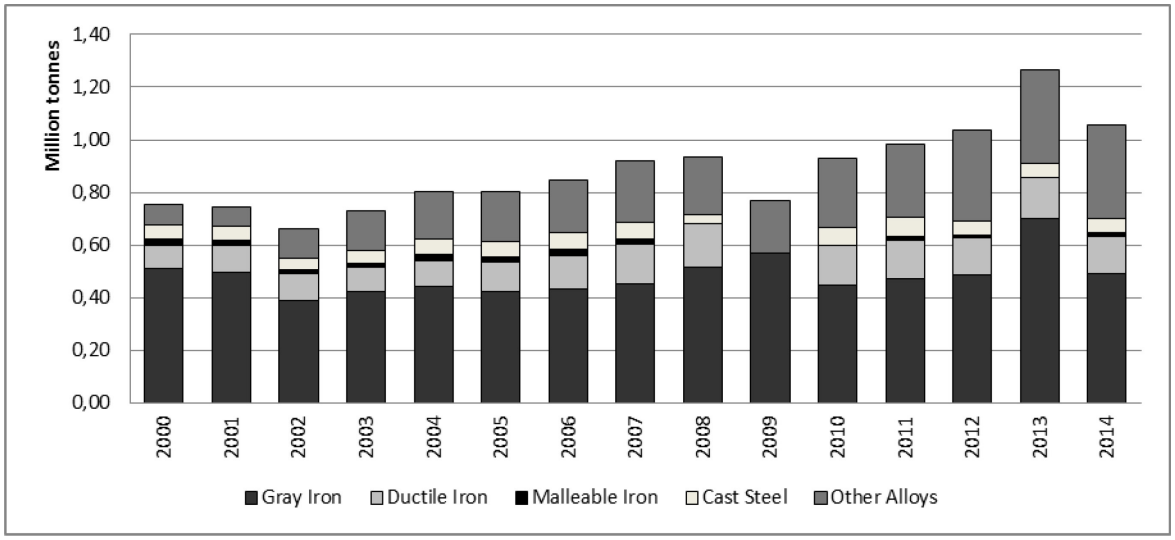

Fig. 3. Production of castings in Poland over the years 2000-2014 and the fractions of basic cast alloys in the production volume [5-19]

Changes in the volume of foundry production over the considered period of time can be also observed by finding changes in the index of production growth. The results of calculations with respect both to the global and to the national foundry production are shown in Fig. 4.

Table 2 compares the foundry production volumes in years 2000 and 2014 with respect to the individual types of cast alloys, both generally in the world and specifically in Poland.

The year-on-year changes in the production volume over the 2000-2014 period, both on a global scale and in Poland, are presented in Fig. 5.

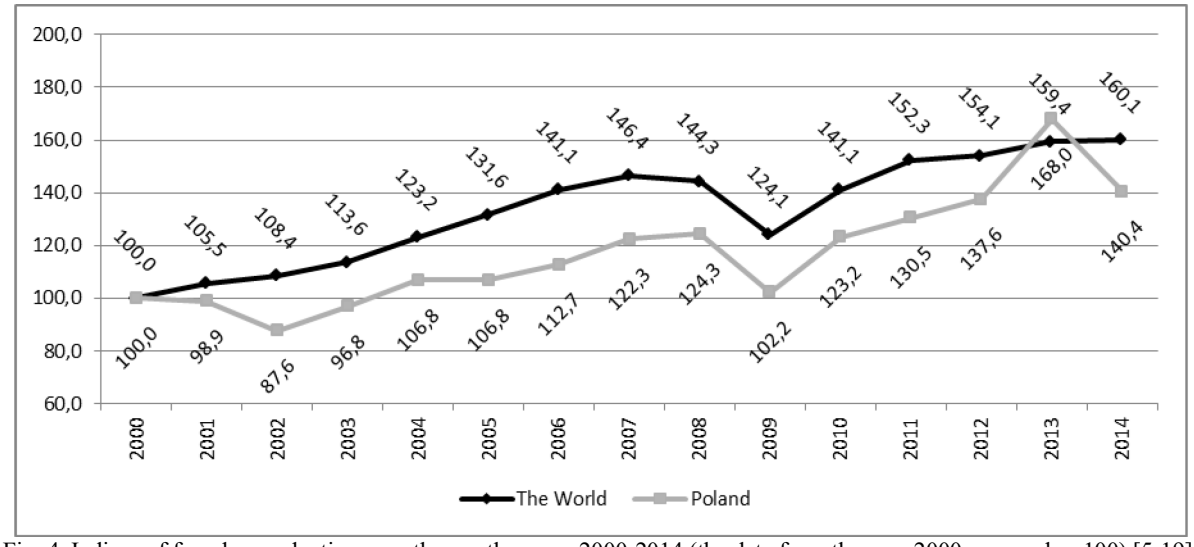

Fig. 4. Indices of foundry production growth over the years 2000-2014 (the data from the year 2000 assumed as 100) [5-19]: with respect to the global production; with respect to the production in Poland

Table 2.
Foundry production volumes in the world and in Poland in years 2000 and 2014 with respect to the basic cast alloys [5, 19]

Considered region	Cast alloys	Production volume in tonnes		Fraction of the global production		Fraction of the production in Poland	
		2000	2014	2000	2014	2000	2014
The world in general	Gray iron	34 034 171	47 461 966	52.56%	45.79%	---	---
	Ductile iron	13 102 599	25 032 847	20.24%	24.15%	---	---
	Malleable iron	991 941	900 818	1.53%	0.87%	---	---
	Cast steel	6 369 684	11 049 705	9.84%	10.66%	---	---
	Copper-based alloys	1 058 120	1 680 630	1.63%	1.62%	---	---
	Aluminium alloys	8 045 648	16 230 137	12.43%	15.66%	---	---
	Magnesium alloys	104 873	192 637	0.16%	0.19%	---	---
	Zinc alloys	829 651	599 374	1.28%	0.58%	---	---
	Other non-ferrous alloys	213 552	493 404	0.33%	0.48%	---	---
Poland	Gray iron	510 000	489 000	0.79%	0.47%	67.68%	46.21%
	Ductile iron	90 500	145 000	0.14%	0.14%	12.01%	13.70%
	Malleable iron	20 300	11 000	0.03%	0.01%	2.69%	1.04%
	Cast steel	55 400	55 000	0.09%	0.05%	7.35%	5.20%
	Copper-based alloys	18 000	6 000	0.03%	0.01%	2.39%	0.57%
	Aluminium alloys	50 000	340 000	0.08%	0.33%	6.63%	32.13%
	Magnesium alloys	data lacking		data lacking		---	---
	Zinc alloys	7 400	8 000	0.01%	0.01%	0.98%	0.76%
	Other non-ferrous alloys	2 000	4 300	0.00%	0.00%	0.27%	0.41%

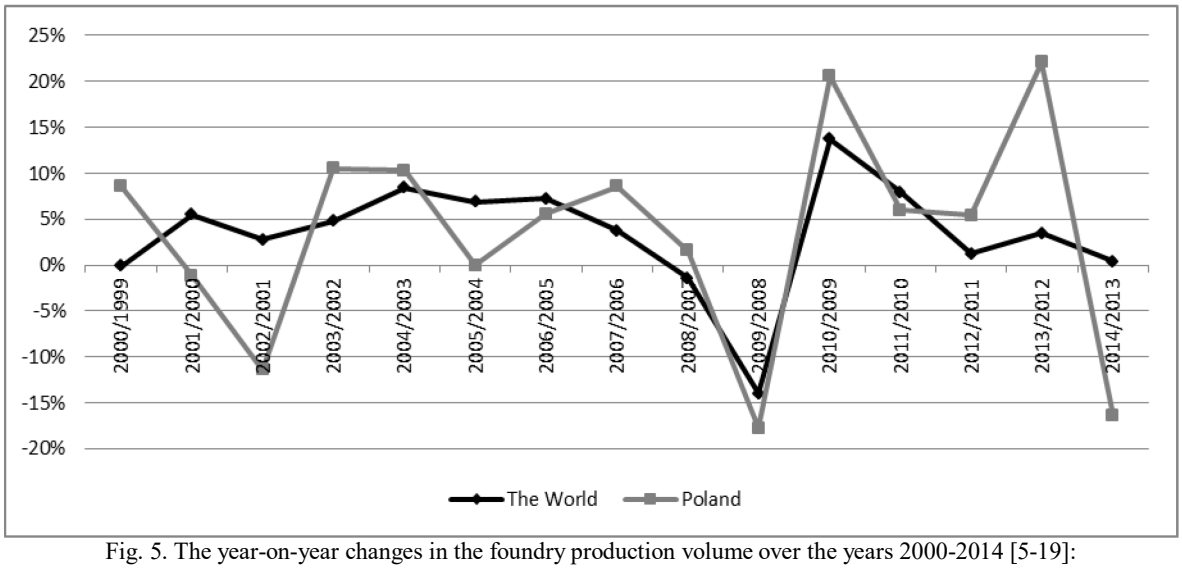

Fig. 5. The year-on-year changes in the foundry production volume over the years 2000-2014 [5-19]: on the global scale; with respect to Poland

3. Conclusion

The production of castings over the period of past 15 years (up to the year 2014, the last included in the available censuses) increased on a global scale from about 64.75 million tonnes to about 103.64 million tonnes (i.e. by about 60% – see Figures 2 and 4 along with the Table 1). The average annual rate of this increase exceeded 3.4%. Over the same period, the production of castings in Poland increased from about 0.75 million tonnes to about 1.06 million tonnes (i.e. by about 40% – see Figures 3 and 4 along with the Table 1), and the average annual index of growth nearly reached 2.5%. It is worth noticing that over the five-year-long 2000-2014 period the global production permanently increased, though not at the equal rate (see Figs. 2 and 3). As far as the foundry production in Poland is concerned over the same 2000-2014 period, two years of remarkably dynamic growth can be observed, 2010 and 2013, and then, in the year 2014, there occurred a drop in the foundry production to the level of the year 2012 (see Figs. 3 and 4). It can be concluded from the Fig. 3 that the increase in production volume in 2013 was related to the rapidly increased production of grey iron castings, and the following drop in the total production of castings – with the corresponding decrease in the production of castings made of this particular type of material. The statistic studies [17-19] report that the production of grey cast iron in Poland in the subsequent years 2012, 2013, and 2014 was equal to 486, 700, and 489 million tonnes, respectively.

During the considered fifteen-year-long period, the production of castings in the world distinctly 'shifted' from Europe and the North America to Asia (see Fig. 1). By now, about 70% of the global foundry production is located over the latter continent. The data quoted in Table 1 show that China is the world leader in the foundry industry (with almost 45% share in the foundry market in 2014). The second position belongs to the USA, the third to India. The shares in world production of once large producers of castings dropped distinctly over the years 2000-2014, e.g. the share of USA (from about 20% to about 10%), Japan (from almost 10% to about 5%), Germany (from about 7% to about 5%), Russia (from about 10% to about 4%), Italy (from nearly 4% to about 2%), France (from over 4% to less than 2%). The shares of Poland in the world foundry production in years 2000 and 2014 were 1.16% and 1.02%, respectively. The share in 2013 was larger than in 2014 and equal to 1.23% [4].

A comparison of data juxtaposed in Table 2, coming from years 2000 and 2014, reveals that the fractions of castings made of such materials as ductile iron or aluminium alloys increase both on a global scale and in Poland. On the other hand, the grey cast iron and malleable iron are in decline.

It can be observed that the year-on-year changes in the foundry production volume over the years 2000-2014, both on a global scale and with respect to Poland, exhibit generally a similar dynamics. The distinct difference occurred, however, in the last reported year (2014), when a noticeable drop in the production of castings took place in Poland (in comparison to the year 2013).

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