

Production of Castings in the World and in Selected Countries from 1999 to 2013

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Abstract

The paper compares the foundry production in years 1999-2013 on a world scale, in countries counted among the leading producers of castings, and in Poland. Various types of foundry alloys were taken into account. It was found that the position of China – the leader in the world production of castings – was not changed over many years, however China's share in the total production of casting has stabilised at the level of 42-44% during the recent five years. In the analysed period of time Poland increased the share in the world production of castings from 1.07% to about 1.23%, so that Polish production of castings was almost doubled. There is a tendency on the world scale that the grey cast iron fraction in the total production of castings decreases, while an increase occurs as far as spheroidal graphite cast iron, cast steel, and aluminium alloy castings are concerned.

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

1. Introduction

Analysis of the production volume of castings, both on a world scale and with respect to the leading producers, allows to perceive the significant tendencies occurring currently in the foundry industry, especially while taking into account the types of cast alloys, and considering some longer period of time. Statistic data permit to determine which materials gain in importance, and which are growing less popular. Moreover, it can be also found, which regions or countries of the world exhibit the growth in the production of casting, and where the production tends to slow down or even decreases. It seems also interesting to compare tendencies in global production of castings and the tendencies revealed by Polish foundry industry.

2. Production of castings during the past 15 years

In the second half of the previous century, and especially in its last decades, the near end of the 'iron era' was announced. One of major premises for this prediction was the rapid growth of the plastics industry. The reality occurred to be completely different. So, for example, if the annual production of steel amounted to about 800 million tons in the last two years of the XX century, the annual production reported in 2004 reached the level of a billion tons, and in 2013 (i.e. in the latest statistically processed period) achieved about 1.6 billion tons. Changes in global production of steel (which is a certain reference point) and of castings, along with the number of foundries, are presented in Figure 1 over the period 1999-2013; the data were taken from References [1-28], accordingly.

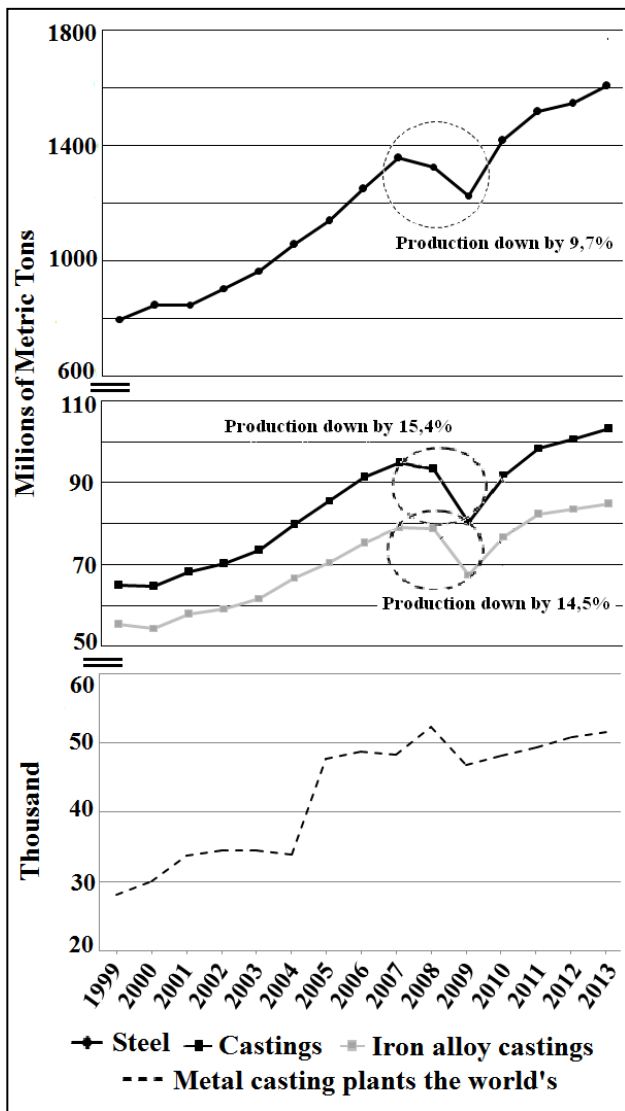


Fig. 1. Global production of steel and castings, and the number of foundries over the period 1999-2013 [1-28]

Fig. 2 compares data referring to the foundry production in the analysed period of time, taking into account types of foundry alloys.

Changes in the volume of production volume in countries counted among the world's leading producers and in Poland over the analysed period of time with respect to the individual types of alloys are indicated in Figures 3 to 9, while Fig. 10 depicts the changes in the total foundry production in the same countries.

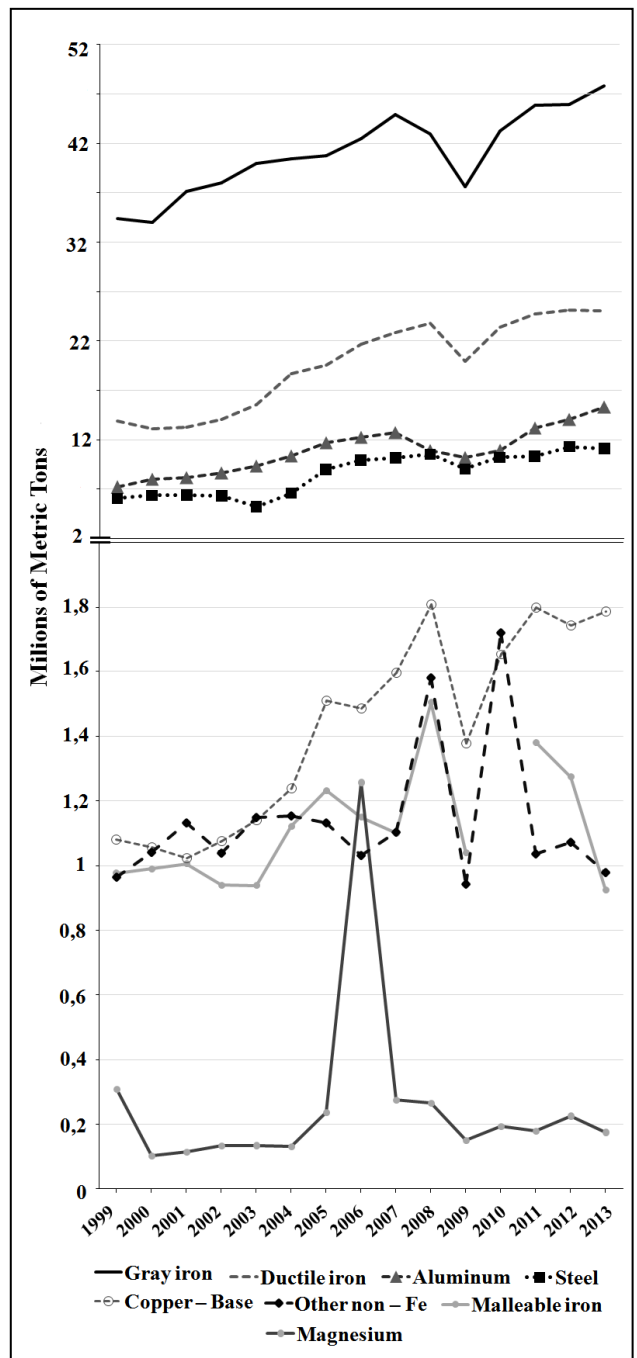


Fig. 2. Global foundry production over the period 1999-2013 [1-28]

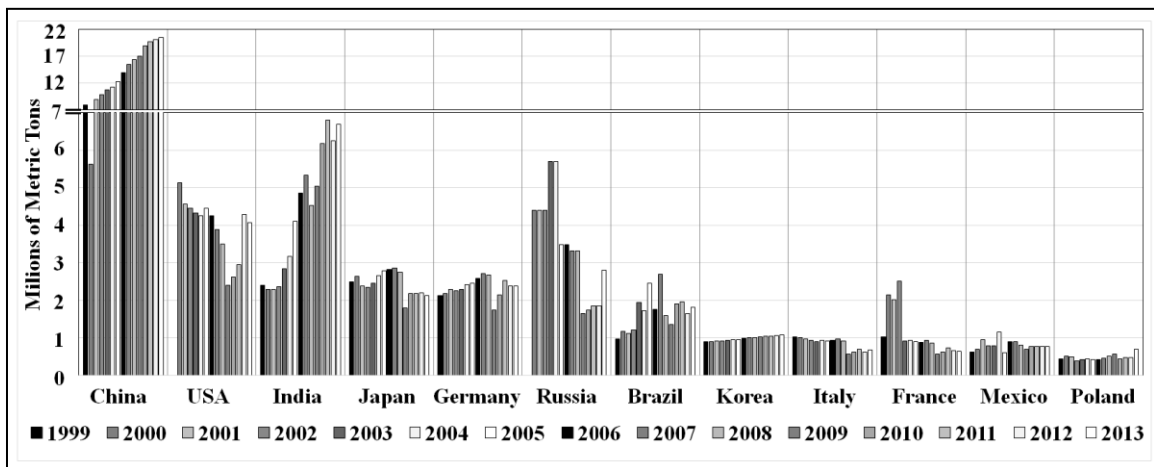


Fig. 3. The production volume of grey iron castings in the selected 12 countries. The subsequent bars from left to right refer to the successive years from the period 1999-2013. If data are lacking, the bar is omitted [1-15]

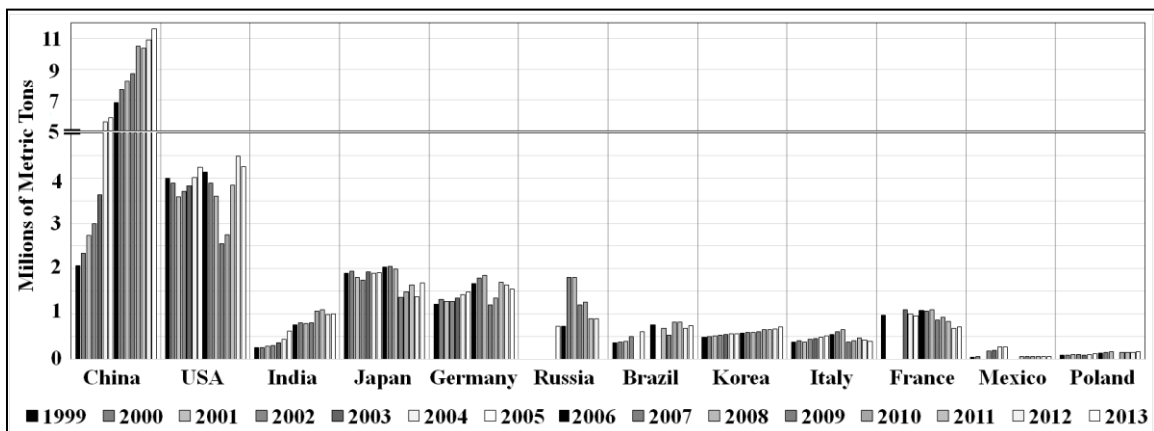


Fig. 4. The production volume of SG iron castings in the selected 12 countries. The subsequent bars from left to right refer to the successive years from the period 1999-2013. If data are lacking, the bar is omitted [1-15]

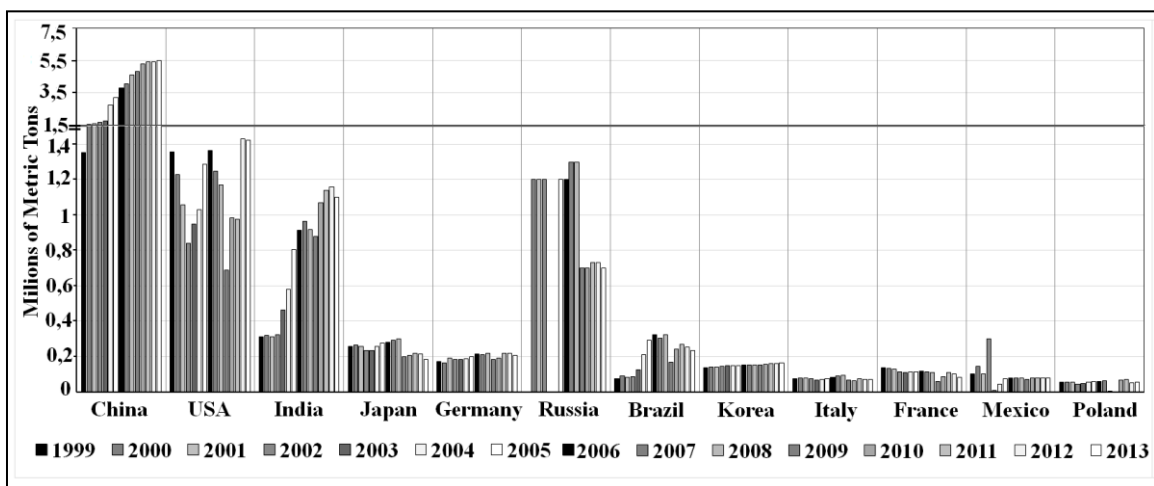


Fig. 5. The production volume of cast steel castings in the selected 12 countries. The subsequent bars from left to right refer to the successive years from the period 1999-2013. If data are lacking, the bar is omitted [1-15]

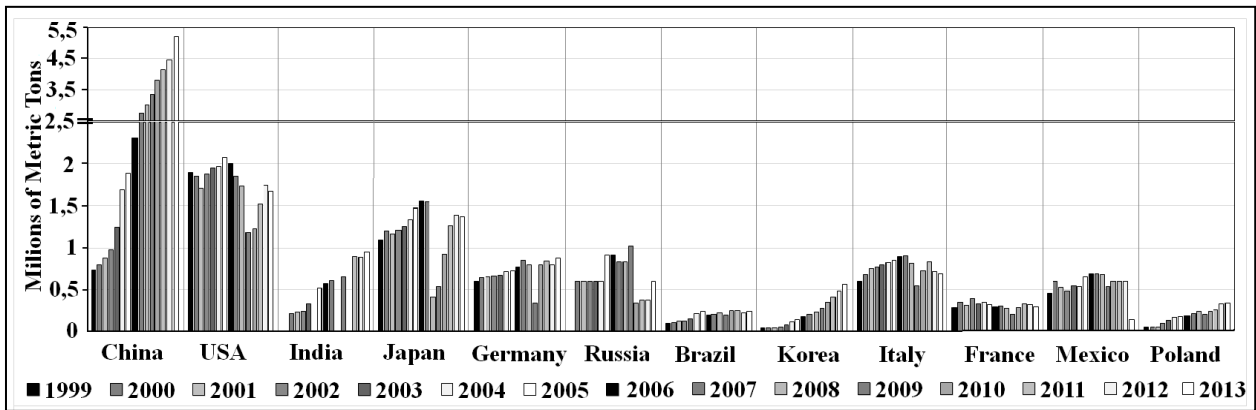


Fig. 6. The production volume of aluminium alloy castings in the selected 12 countries. The subsequent bars from left to right refer to the successive years from the period 1999-2013. If data are lacking, the bar is omitted [1-15]

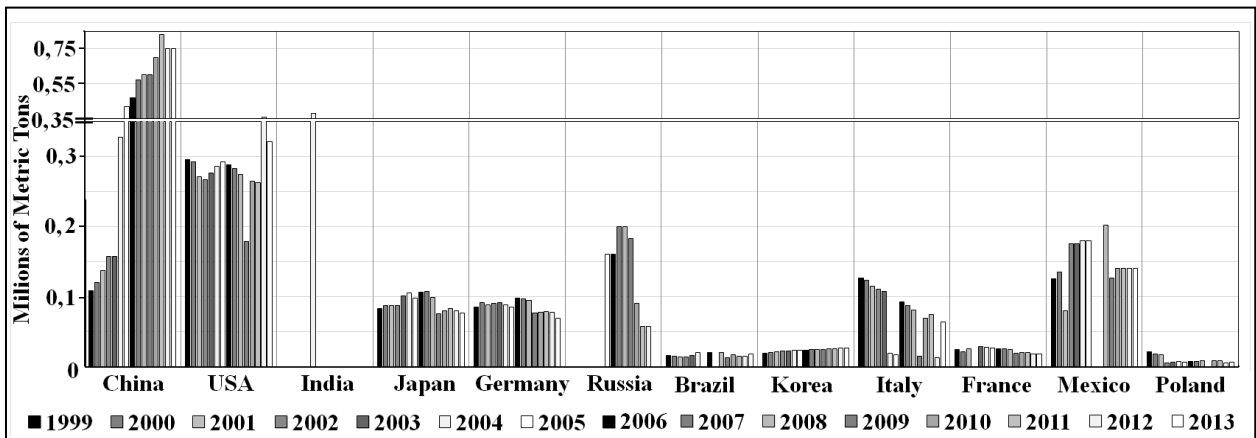


Fig. 7. The production volume of copper alloy castings in the selected 12 countries. The subsequent bars from left to right refer to the successive years from the period 1999-2013. If data are lacking, the bar is omitted [1-15]

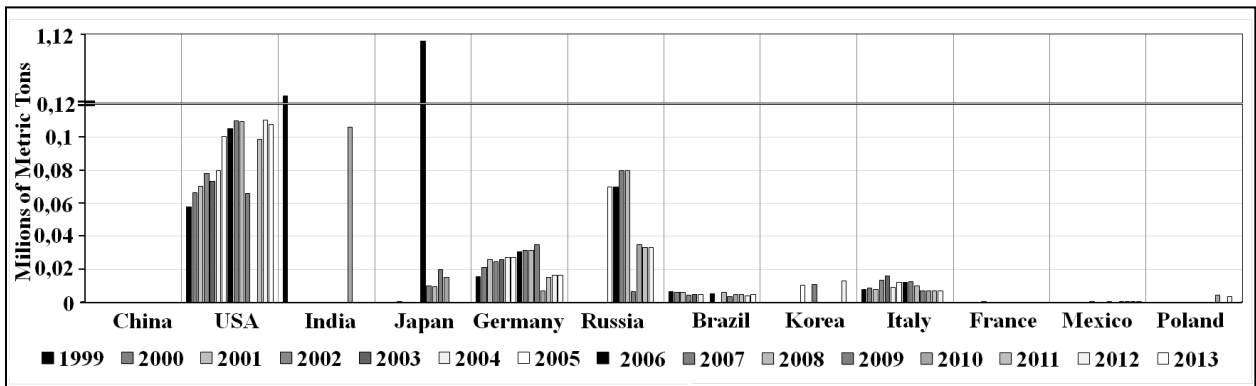


Fig. 8. The production volume of magnesium alloy castings in the selected 12 countries. The subsequent bars from left to right refer to the successive years from the period 1999-2013. If data are lacking, the bar is omitted [1-15]

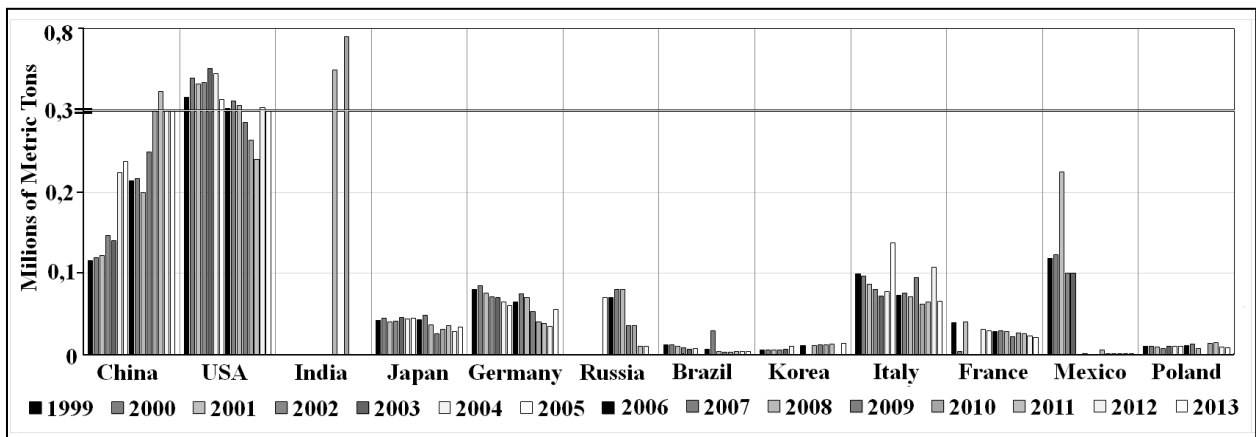


Fig. 9. The production volume of other non-ferrous alloy castings in the selected 12 countries. The subsequent bars from left to right refer to the successive years from the period 1999-2013. If data are lacking, the bar is omitted [1-15]

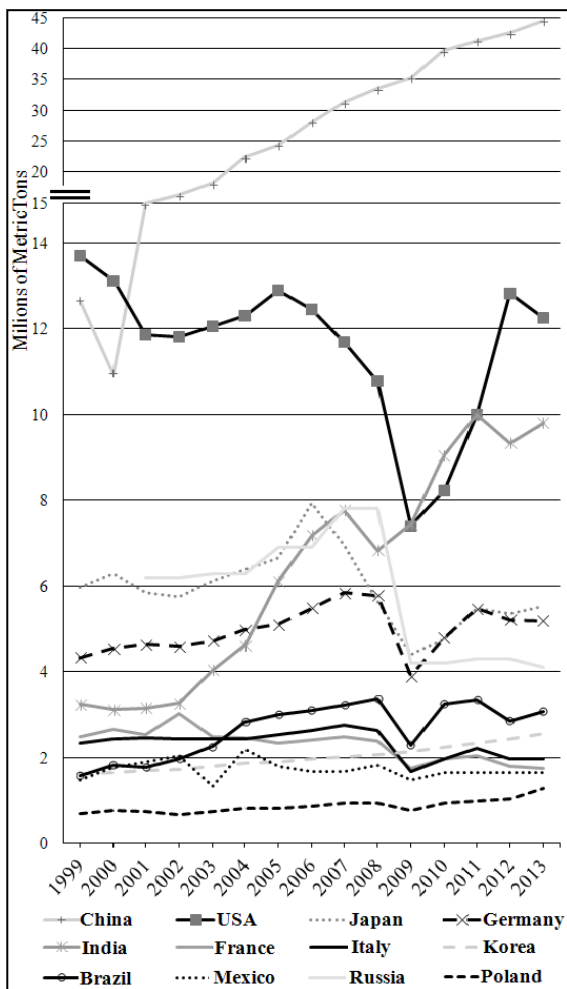


Fig. 10. Changes in total foundry production volume in countries being world's leading producers and in Poland

Analysis of the statistic data allowed to determine the shares of the total foundry production in individual years for the largest producers of castings (Fig. 11).

Fig 12 compares the fractions of the total world production of castings falling to the individual alloys in the considered period of time.

The changes in global production of castings year by year were also calculated (Fig. 13). The production volumes in the year 1999 and 2013 on a global scale and in the individual countries are compared in Table 1, and the statistic data concerning the average annual rate of change in production volume are also given here.

Table 1. Average rate of change in the foundry production volume in the examined period

	Production in millions of tons		Average annual rate of change in production volume
	1999	2013	
World in total	64881040	103229774	3.37%
China	12647476	44500000	9.4%
USA	13710000	12250000	-0.8%
India	3240000	9810000	8.2%
Japan	5972122	5538037	-0.5%
Germany	4332639	5186727	1.3%
Russia	6200000	4100000	-3.4%
Brazil	1573952	3071400	4.9%
Korea	1618900	2562000	3.3%
Italy	2324914	1970968	-1.2%
France	2490413	1748166	-2.5%
Mexico	1474120	1651679	0.8%
Poland	694200	1266100	4.4%

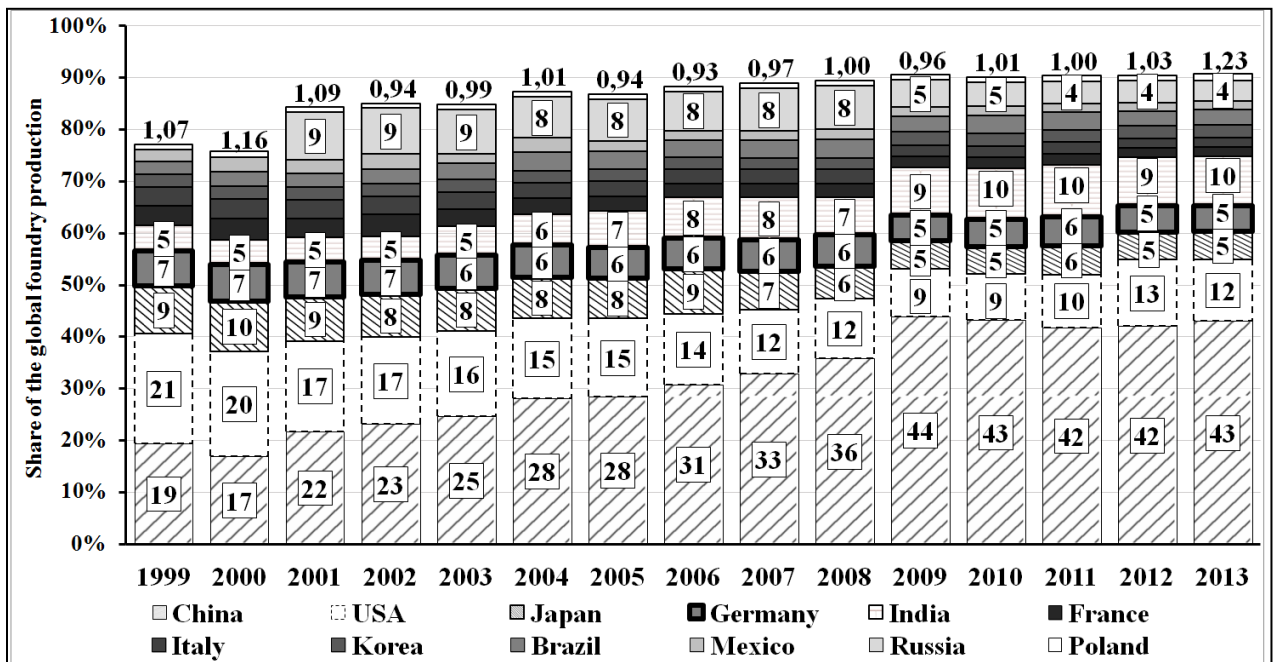


Fig. 11. Shares of the global foundry production in the period 1999-2013 by country (for the leading producers and Poland)

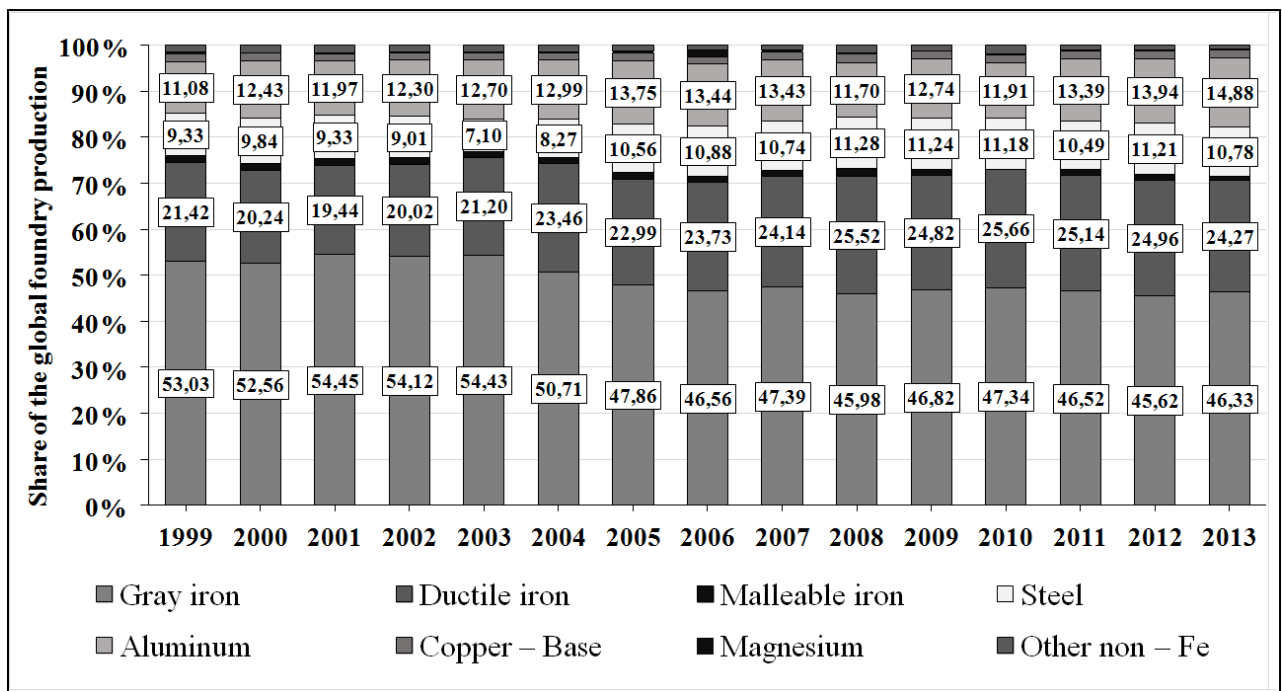


Fig. 12. Comparison of the fractions of the world production of castings by alloy, for main foundry alloys

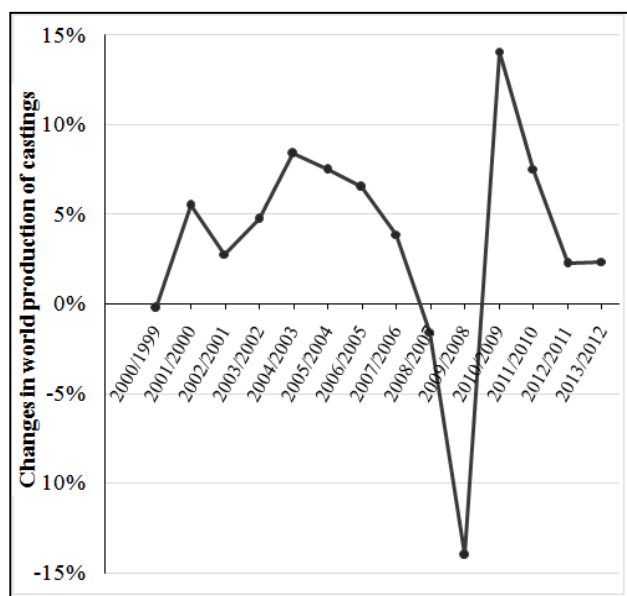


Fig.13. Changes in world production of castings in the period 1999-2013

3. Conclusion

Analysis of data regarding the production volume of both steel and metal castings in countries counted among the largest producers and in Poland allow to make a series of conclusions. During the analysed period, i.e. from 1999 to 2013 (the data from the year 2013 are the latest available in statistic reports), the production of steel increased by 100% - from the level of 800 million tons to about 1600 million tons, what makes the average rate of increase equal to about 5.1%. However, as it happened for many industrial branches, also metallurgy suffered the distinct drop in production at the end of the first decade of the present century; the drop reached about 9.8% in years 2007-2009 (see Fig. 1).

The production of castings on a world scale increased from about 65 million tons to over 103 million tons (see Fig. 1 and Table 1); this means the increase by almost 60%, and the average annual rate of production growth equal to about 3.4%. The number of foundries also significantly increased – from less than 30 thousand to over 50 thousand. Similarly as in the case of steel, the production of castings dropped distinctly down in the period 2007-2009, the decrease in total world production was over 15%, and the decrease in production of the ferrous casting – almost 15% (see Fig. 1). The drop in production occurred for every type of casting alloys, either in the period 2007-2009 or 2008-2009 (Fig.2).

A comparison of changes in the total production volume in countries counted among the leading producers on the world scale (see Fig. 10) indicates that the decrease of production in years 2007-2009 (or 2005-2009 for the USA) was not reflected at all in Chinese industry.

The analysis of data presented in Figures 3 to 9 allow for more intimate perception of the changes occurring in individual

countries, taking into account various types of foundry alloys. It should be mentioned that Figure 8 includes data concerning the production of magnesium alloys in Japan, which – according to the data from the Ref. [8] – was equal to 1 million tons in 2006. This data, however, are incredibly high as compared with the global production, and are probably incorrect.

The significant growth in foundry production in China, India, and – to the less extent – in Brazil is worth noticing. The data in Table 1 confirm this unquestionably. The production of castings in China increased from less than 13 million tons in 1999 to over 44 million tons in 2013 (the average annual growth of 9.4%). India started from about 3 million tons and reached almost 10 million tons in the same period of time (the average annual growth by 8.2%), Brazil doubled its production volume – from over 1.5 million tons to over 3 million tons (the average annual increase of about 4.9%).

The production of castings in Poland also increased distinctly during the analysed period of time, from about 700 thousand tons in 1999 to almost 1300 thousand tons in 2013. The average rate of production growth was equal to 4.4%, and this places Poland among the world leaders with respect to this indicator.

An increase in the production of castings in China, India, or Brazil in 1999-2013, significantly higher than the average annual increase in foundry production on the world scale, resulted in the distinctly increased shares of these countries in global production of castings: from 19% to 43% in the case of China, from 5% to 10% in the case of India, and from 2% to 3% as far as Brazil is considered. It should be noticed that the share of the largest producer of castings in the world, i.e. of China, has stabilised during the recent five years at the level of 42-44%. In turn, the share of some large producers of castings decreased within the considered period of time: USA from about 21% to about 12-13%, Japan from about 9-10% to about 5%, and Germany from about 7% to about 5%. It is worth noticing that Poland increases the share in the world production of castings from about 1.07% to about 1.23%.

The data given in Fig.12 indicate that the fraction of grey cast iron castings in the total production of casting diminished (from about 53% to about 46%), the fraction of spheroidal graphite cast iron castings increased (from about 21% to about 24%), the growth is also observed for cast steel castings (from about 9% to about 11%). The fraction of aluminium alloy castings increased as well (from about 11% to almost 15%). Malleable iron, in turn, is getting less significant in the production of castings.

The analysed period of time in Poland is characterised by the stabilisation of the fraction of spheroidal graphite cast iron casting in the total production of castings (at the level of about 12.5%), and the increase in the fraction of aluminium alloy castings (from about 7.7% to nearly 27%). The fraction of cast steel castings in the total production of castings decreased from about 8% in 1999 to nearly 4.5% in 2013. It should be also noticed that the rapid drop in the foundry production in the period 2007-2009 was preceded by several years of slower and slower growth in the production of this type (see Fig. 13).

References

- [1] A modern casting Staff Report. 34th Annual Census of World Casting Production – 1999. *Modern Casting*. December 2000. 30-31.
- [2] A modern casting Staff Report. 35th Census of World Casting Production – 2000. *Modern Casting*. December 2001. 38-39.
- [3] A modern casting Staff Report. 36th Census of World Casting Production – 2001. *Modern Casting*. December 2002. 22-24.
- [4] A modern casting Staff Report. Know Your Competition. 37th Census of World Casting Production – 2002. *Modern Casting*. December 2003. 23-25.
- [5] A modern casting Staff Report. 38th Census of World Casting Production – 2003. *Modern Casting*. December 2004. 25-27.
- [6] A modern casting Staff Report. 39th Census of World Casting Production – 2004. *Modern Casting*. December 2005. 27-29.
- [7] A modern casting Staff Report. 40th Census of World Casting Production – 2005. *Modern Casting*. December 2006. 28-31.
- [8] A modern casting Staff Report. 41th Census of World Casting Production – 2006. *Modern Casting*. December 2007. 22-25.
- [9] A modern casting Staff Report. 42th Census of World Casting Production – 2007. *Modern Casting*. December 2008. 24-27.
- [10] A modern casting Staff Report. 43th Census of World Casting Production – 2008. *Modern Casting*. December 2009. 17-21.
- [11] A modern casting Staff Report. 44th Census of World Casting Production. *Modern Casting*. December 2010. 23-27.
- [12] A modern casting Staff Report. 45th Census of World Casting Production. *Modern Casting*. December 2011. 16-19.
- [13] A modern casting Staff Report. 46th Census of World Casting Production. *Modern Casting*. December 2012. 25-29.
- [14] A modern casting Staff Report. 47th Census of World Casting Production. Dividing up the Global Market. *Modern Casting*. December 2013. 18-23.
- [15] A modern casting Staff Report. 48th Census of World Casting Production. Steady Growth in Global Output. *Modern Casting*. December 2014. 17-21.
- [16] Statistical Yearbook of the Republic of Poland. Central Statistical Office. Warsaw 1999. 691.
- [17] Statistical Yearbook of the Republic of Poland. Central Statistical Office. Warsaw 2000. 678.
- [18] Statistical Yearbook of the Republic of Poland. Central Statistical Office. Warsaw 2001. 690.
- [19] Statistical Yearbook of the Republic of Poland. Central Statistical Office. Warsaw 2002. 704.
- [20] Statistical Yearbook of the Republic of Poland. Central Statistical Office. Warsaw 2003. 732.
- [21] Statistical Yearbook of the Republic of Poland. Central Statistical Office. Warsaw 2004. 819.
- [22] Statistical Yearbook of the Republic of Poland. Central Statistical Office. Warsaw 2005. 833.
- [23] Statistical Yearbook of the Republic of Poland. Central Statistical Office. Warsaw 2006. 829.
- [24] Statistical Yearbook of the Republic of Poland. Central Statistical Office. Warsaw 2007. 843.
- [25] Statistical Yearbook of the Republic of Poland. Central Statistical Office. Warsaw 2008. 850.
- [26] Statistical Yearbook of the Republic of Poland. Central Statistical Office. Warsaw 2009. 859.
- [27] Statistical Yearbook of the Republic of Poland. Central Statistical Office. Warsaw 2010. 922.
- [28] Statistical Yearbook of the Republic of Poland. Central Statistical Office. Warsaw 2011. 850.