REPORT R92/2012

SOUTH AFRICA'S FERROALLOYS PRODUCTION TRENDS

2001-2010

DIRECTORATE: MINERAL ECONOMICS

mineral resources
Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

REPORT R92/2012

SOUTH AFRICA'S FERROALLOYS PRODUCTION TRENDS

2001-2010

DIRECTORATE: MINERAL ECONOMICS

Compiled by: Ms K Ratshomo

Email: (keneilwe.ratshomo@dmr.gov.za)

Picture on front cover

Source: www.esuppliersindia.com

Issued by and obtainable from

The Director: Mineral Economics, Trevenna Campus,

70 Meintjies Street, Arcadia, Pretoria 0001, Private Bag X59, Arcadia 0001

Telephone (012)444-3536, Telefax (012) 444-3134

Website: http://www.dmr.gov.za

DEPARTMENT OF MINERAL RESOURCES

Director General — Dr. T. Ramontja

MINERAL POLICY AND PROMOTION BRANCH

Acting Deputy Director-General — Mr. T. Nell

MINERAL PROMOTION CHIEF DIRECTORATE

Chief Director — Ms. S. Mohale

DIRECTORATE MINERAL ECONOMICS

Acting Director: Mineral Economics — Ms. N. Dlambulo

Acting Deputy Director: Precious Metals and Minerals and Ferrous Minerals — Mr. D. Moumakwa

This, the first edition published in 2012

ISBN: 978-0-621-40732-7

TABLE OF CONTENTS

Contents **Page**

LIST OF FIGURES

1. INTRODUCTION

South Africa was the world's leading producer of ferrous alloys for the last decade. Historical factors that contributed to this position included an abundance of resources and relatively low cost electricity. However, there have been factors on both global and local fronts that have had an effect on the country's ferrous alloys industry in recent years.

China's economic growth and infrastructure developments during the past ten years have been the driving force in the world's ferroalloy industry growth. This provided the South African ferroalloys industry opportunities for downstream value addition, on the back of the government's industrialisation policy calls for a paradigm shift in mineral development. However, South Africa's infrastructure facilities were put under pressure, and as a result, held back the industry from exporting higher volumes to take full advantage of the surging Chinese industrial market. The infrastructural constraints also hindered investments in the industry.

South Africa's electricity shortages in 2007 through 2009, had a negative effect in the country's ferroalloy production, leading to producers reducing their production capacity by a minimum of 10 percent during this period.

The global economic recession, which became apparent in the commodity market during the last quarter of 2008 and persisted to the first half of 2009, also had a negative impact on both South Africa's and the international ferroalloys market. However, the commodity market started to recover during the second half of 2009 and continued into 2010. Some of this recovery can be attributed to the timely intervention of the governments of major economies, which provided stimulus packages to arrest further deterioration of the economic crisis and effectively brought forward future steel demand.

This report seeks to investigate how South Africa's ferroalloys production trends have been affected during the study period 2001 to 2010. Also incorporated are local and export sales trends based on volumes. The ferroalloys focused on include chromium, manganese, silicon and vanadium ferroalloys.

2. CHROMIUM ALLOYS

Ferrochrome (FeCr) is an alloy of chromium and iron, which contains between 50 to 70 percent chromium. Chromium ore is reduced by coal and coke to form the iron-chromium alloy. The production of the alloy is essentially a carbo-thermic reduction process taking place at high temperatures.

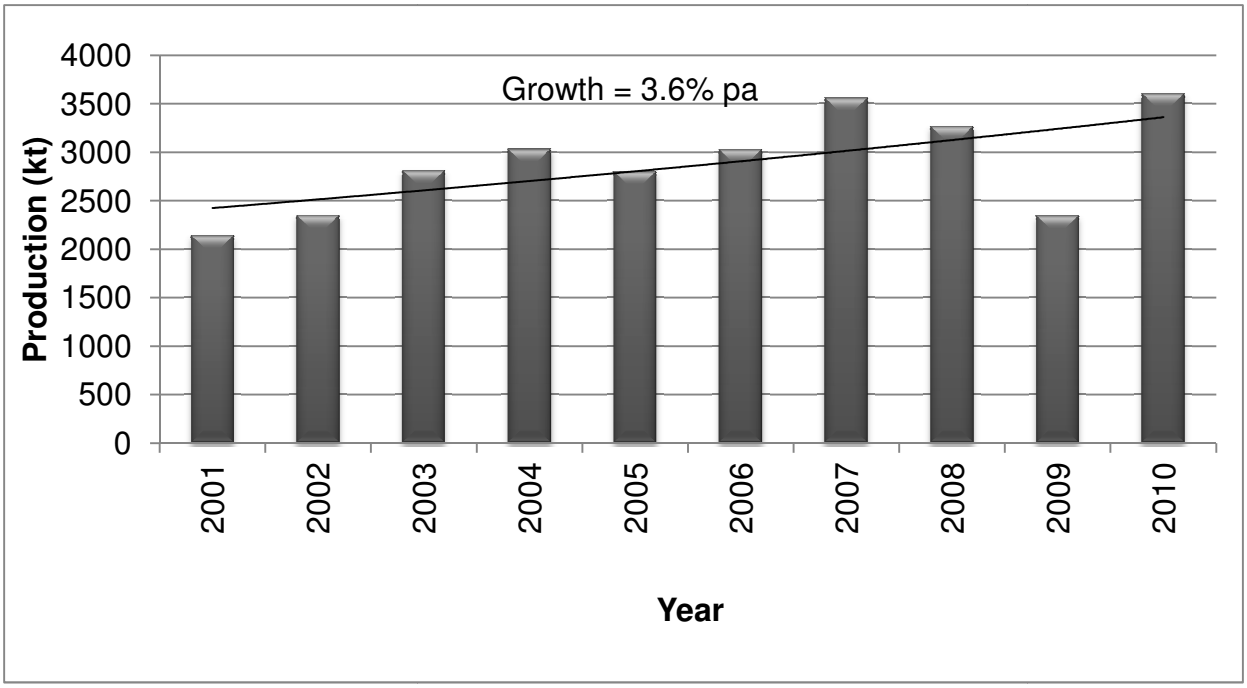
Over 90 percent of the world's ferrochrome is utilised in the production of stainless steel, which depends on chromium for its appearance and resistance to corrosion. The average chrome content in stainless steel is approximately 18 percent.

Ferrochrome is often classified by the amount of carbon and chrome it contains, namely, high (3-8%) , medium (<3%) and low (≤0.1%) carbon ferrochrome. The vast majority of FeCr produced in South Africa is high carbon ferrochrome also known as charge chrome.

2.1. South Africa's Supply of Ferrochrome

South Africa's ferrochrome production had an annual average growth rate of 3.6 percent, from 2.1 Mt in 2001 to 3.6 Mt in 2010 (Fig.1). The country went from contributing 46.6 percent in 2001 to 40.8 percent in 2010 to the world's ferrochrome production over the ten years under study. Production peaked at 3.6 Mt in 2007 despite a 2.6 percent decline in world stainless steel production during the same year. In 2008, South Africa's energy supply shortage as well as the global economic crisis, that occurred during the last quarter of that year, negatively impacted on South Africa's ferrochrome industry resulting in an 8 percent decline in production. The crisis continued into the first half of 2009, resulting in a 28 percent decline in ferrochrome production in 2009. However, the market recovered during 2010, increasing demand. As a result, South Africa's ferrochrome production increased by 53.8 percent in 2010, making the country the largest ferrochrome producer in the world throughout the study period.

FIGURE 1: SOUTH AFRICA'S PRODUCTION OF FERROCHROME, 2001-2010

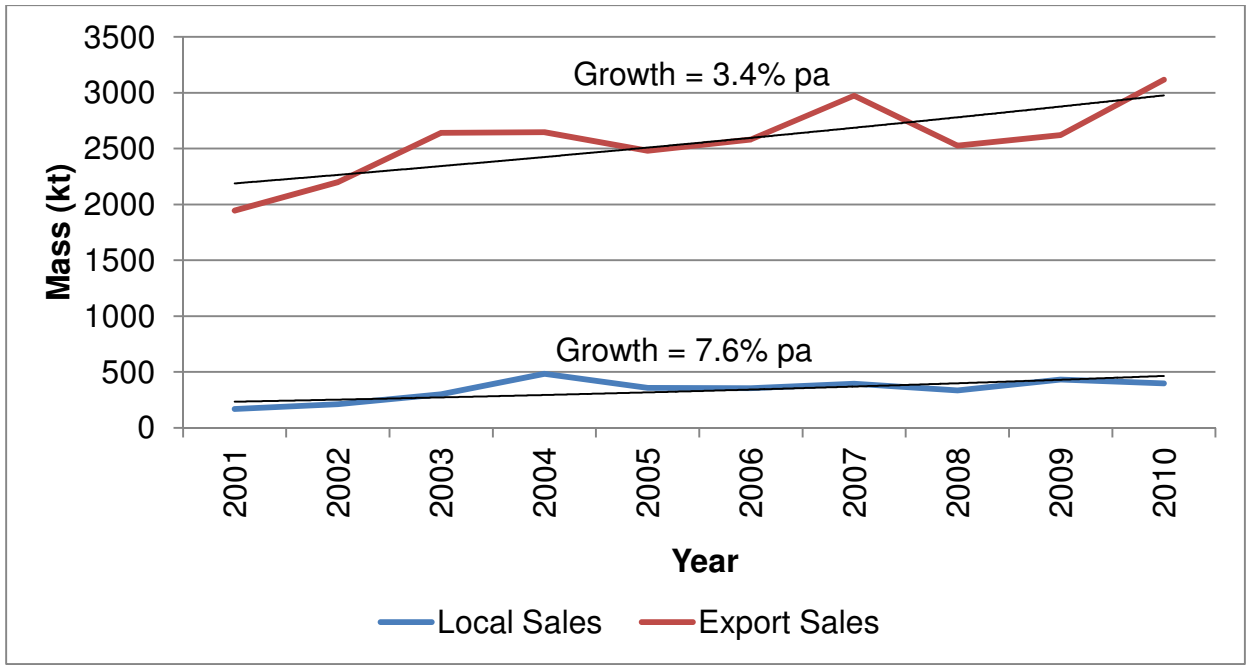


Source: DMR, Directorate Mineral Economics

2.2. South Africa's Demand of Ferrochrome

Local sales volumes of ferrochrome had an average annual growth rate of 7.6 percent from 169 kt in 2001 to 397 kt in 2010 (Fig. 2). A peak was reached in 2004, at 484 kt, due to a higher local demand, followed by a 26 percent decline in 2005 and a further 1.4 percent decline in 2006. Local sales volumes for ferrochrome rose by 29.3 percent in 2009 despite the economic crisis, but declined by 8 percent in 2010 due to lower demand.

FIGURE 2: SOUTH AFRICA'S LOCAL AND EXPORT SALES OF FERROCHROME, 2001-2010



Source: DMR, Directorate Mineral Economics

Export sales volumes had an average growth rate of 3.4 percent from 1.9 Mt in 2001 to 3.1 Mt in 2010 (Fig. 2). South Africa contributed over half of the world's ferrochrome exports during the study period. The ratio of export mass to total sales mass of ferrochrome went from 92 percent in 2001 to 89 percent in 2010 due to the increasingly higher local consumption over the period. Export sales mass declined by 6.3 percent in 2005 and by 15 percent in 2008, driven by weaker demand from the stainless steel industry, which was hit hard by the recession. Also, the electricity shortages in the country led to producers idling up to 10 percent of their capacities. However, export sales mass increased by 3.8 percent in 2009 and a further 18.9 percent in 2010.

3. MANGANESE ALLOYS

Ferromanganese is made by heating a mixture of manganese dioxide (MnO_2) and iron (III) oxide (Fe_2O_3), with carbon, usually as coal and coke, in either a blast furnace or an electric arc furnace-type system, called a submerged arc furnace. The oxides undergo carbo-thermal reduction in the furnaces, producing ferromanganese.

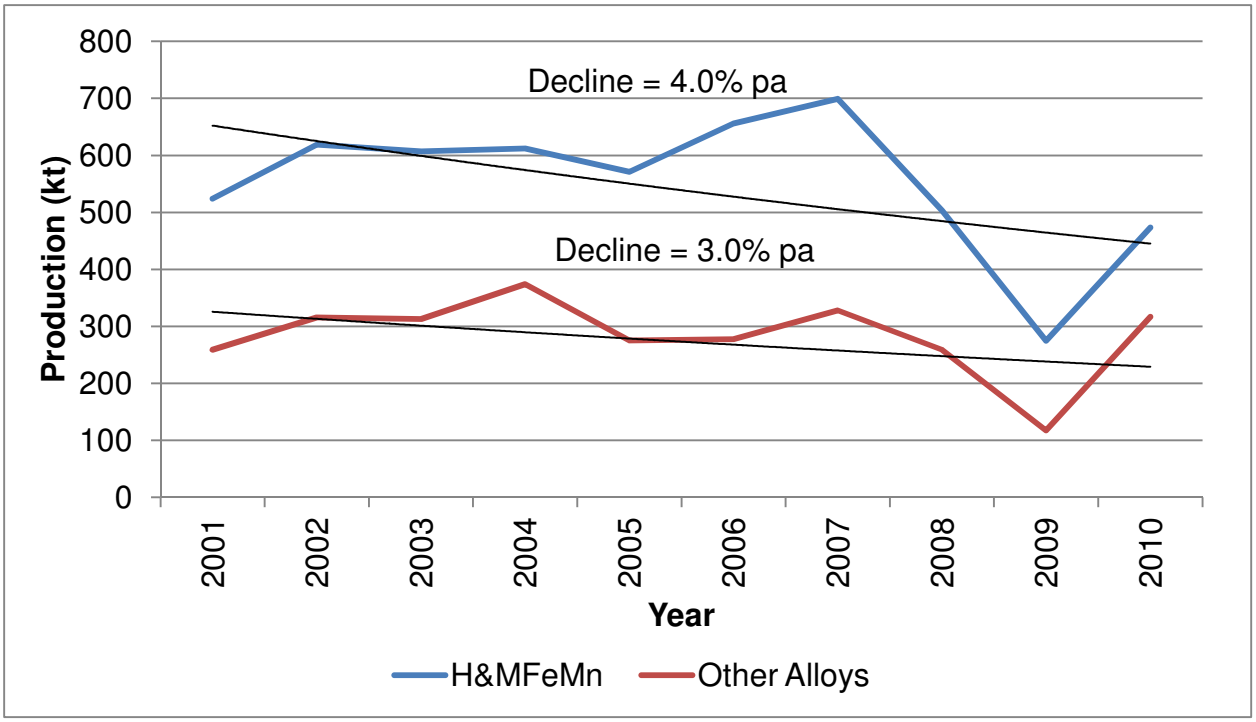
Over 90 percent of ferromanganese is consumed in the steel making industry. Ferromanganese is essential to steel making by virtue of its sulphur-fixing, deoxidizing, and alloying properties. The second largest application for manganese is as an alloying agent for aluminium. Aluminium with a manganese content of about 1.5 percent has an increased resistance against corrosion.

Manganese alloys processed in South Africa include high carbon ferromanganese (HCFeMn), medium carbon ferromanganese (MCFeMn), ferrosilicon manganese (FeSiMn), manganese metal, manganese dioxide (electrolytic), manganese oxide and manganese sulphate.

3.1. South Africa's Supply of Manganese Alloys

South Africa's total production of HCFeMn and MCFeMn declined by an average rate of 4.0 percent per annum from 524 kt in 2001 to 473 kt in 2010 (Fig. 3). Total production of other manganese alloys declined at an annual average rate of 3.0 percent from 259 kt in 2001 to 317 kt in 2010. Total manganese alloys production declined by 14.2 percent in 2005, due to cutbacks in output in order to bring the oversupplied market to a state of equilibrium. In 2007, total manganese alloys production reached its peak of 1 027 kt, driven by higher demand from the world steel market, particularly from China. However, production declined by 25.8 percent and 48.5 percent during 2008 and 2009, respectively, driven mainly by the global economic crisis. Production for manganese alloys recovered during 2010, resulting in a 101.2 percent increase compared with 2009.

FIGURE 3: SOUTH AFRICA'S PRODUCTION OF MANGANESE ALLOYS, 2001-2010

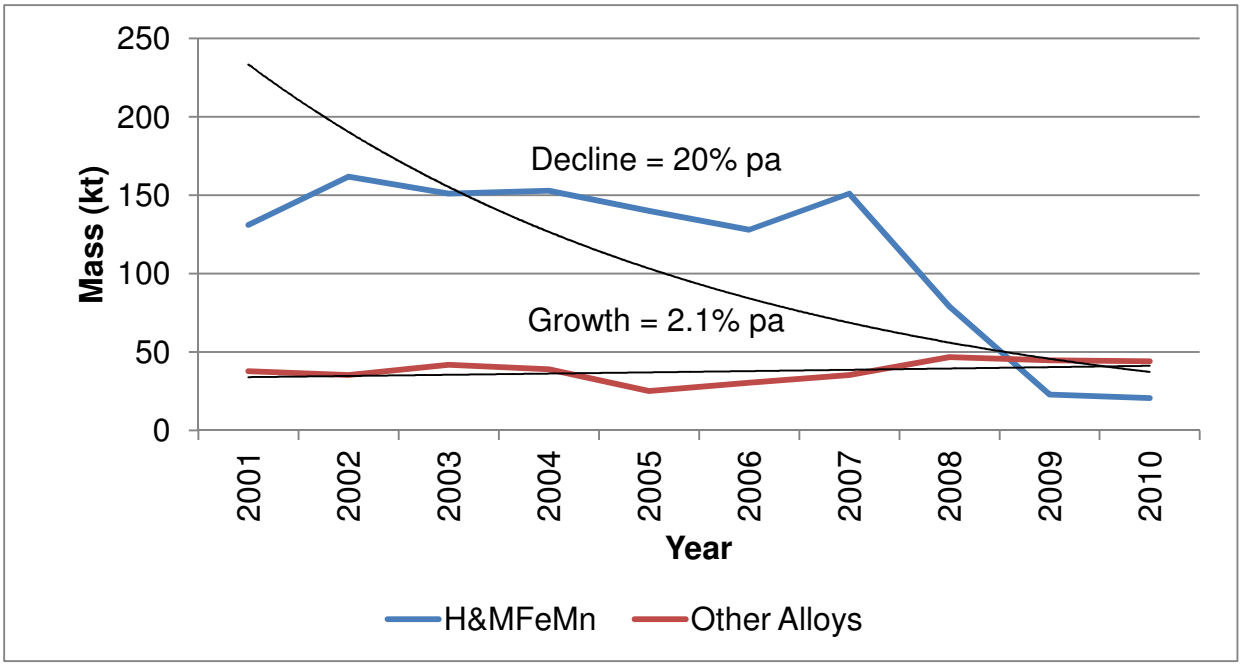


Source: DMR, Directorate Mineral Economics

3.2. South Africa's Demand of Manganese Alloys

South Africa's local sales volumes of HCFeMn and MCFeMn declined at an average rate of 20 percent annually, from 131 kt in 2001 to 21 kt in 2010 (Fig. 4). The highest volume sold locally was 162 kt in 2002, followed by a downward spiral until 2006. In 2007, volumes went up by 18 percent to 151 kt. However, sales volumes declined by 47.7 percent and 70.9 percent in 2008 and 2009, respectively, and a further 9.8 percent in 2010.

FIGURE 4: SOUTH AFRICA'S LOCAL SALES OF MANGANESE ALLOYS, 2001-2010

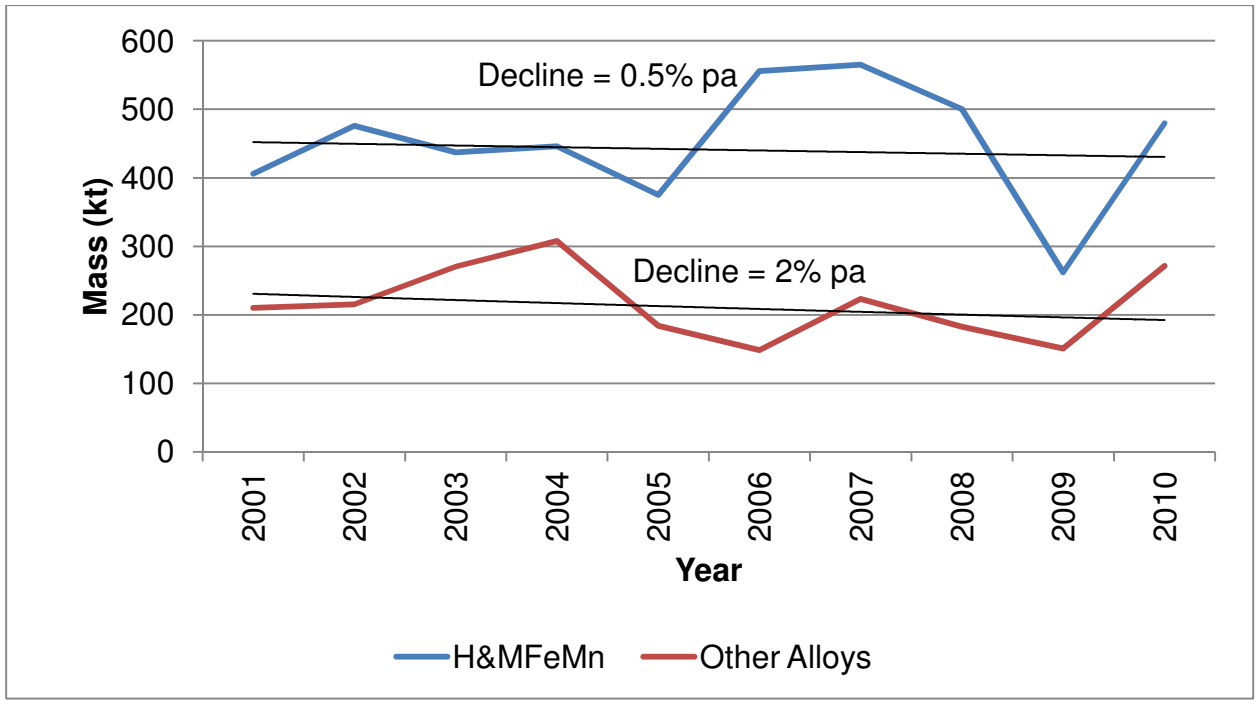


Source: DMR, Directorate Mineral Economics

Local sales volumes of other manganese alloys grew at an annual average rate of 2.1 percent, from 38 kt in 2001 to 44 kt in 2010 (Fig. 4). These alloys reached their lowest local sales of 25 kt in 2005, 35.7 percent lower compared with the previous year and reached their peak of 47 kt in 2008. However, the sales volumes declined by 4.3 percent and 1.5 percent in 2009 and 2010, respectively.

South Africa's export sales volumes of HCFeMn and MCFeMn declined by an average annual rate of 0.5 percent, from 406 kt in 2001 to 480 kt in 2010 (Fig. 5). Export sales volumes declined by 16 percent in 2005 then increased by 48.3 percent in 2006. A peak of 565 kt was attained in 2007 during the commodity boom, mainly driven by China. However, volumes declined by 11.5 percent in 2008 and a further 47.6 percent in 2009 due to the global economic crisis. Export sales volumes increased by 83.1 percent in 2010 due to higher demand.

FIGURE 5: SOUTH AFRICA'S EXPORT SALES OF MANGANESE ALLOYS, 2001-2010



Source: DMR, Directorate Mineral Economics

Export sales volumes of other manganese alloys declined at an average rate of 2.0 percent annually, from 210 kt in 2001 to 271 kt in 2010 (Fig. 5). These volumes declined by 40.2 percent to 184 kt in 2005 from a peak of 308 kt in 2004 and declined by a further 19.3 percent in 2006. Export sales volumes, which grew by 50.3 percent in 2007, went down by 18.3 percent and 17.2 percent in 2008 and 2009, respectively. Other alloys export sales mass increased by 79.8 percent in 2010.

4. SILICON ALLOYS

Silicon does not occur in nature in its pure form, but combines with oxygen to form silica (SO_2), also known as quartz. Silica as quartz is processed into two intermediate products, silicon metal and ferrosilicon. Silicon metal is commercially prepared by the reaction of high purity silica with wood, charcoal and coal in an electric arc furnace using carbon electrodes. Ferrosilicon is produced by the reduction of silica with coke in the presence of scrap iron, millscale or other source of iron.

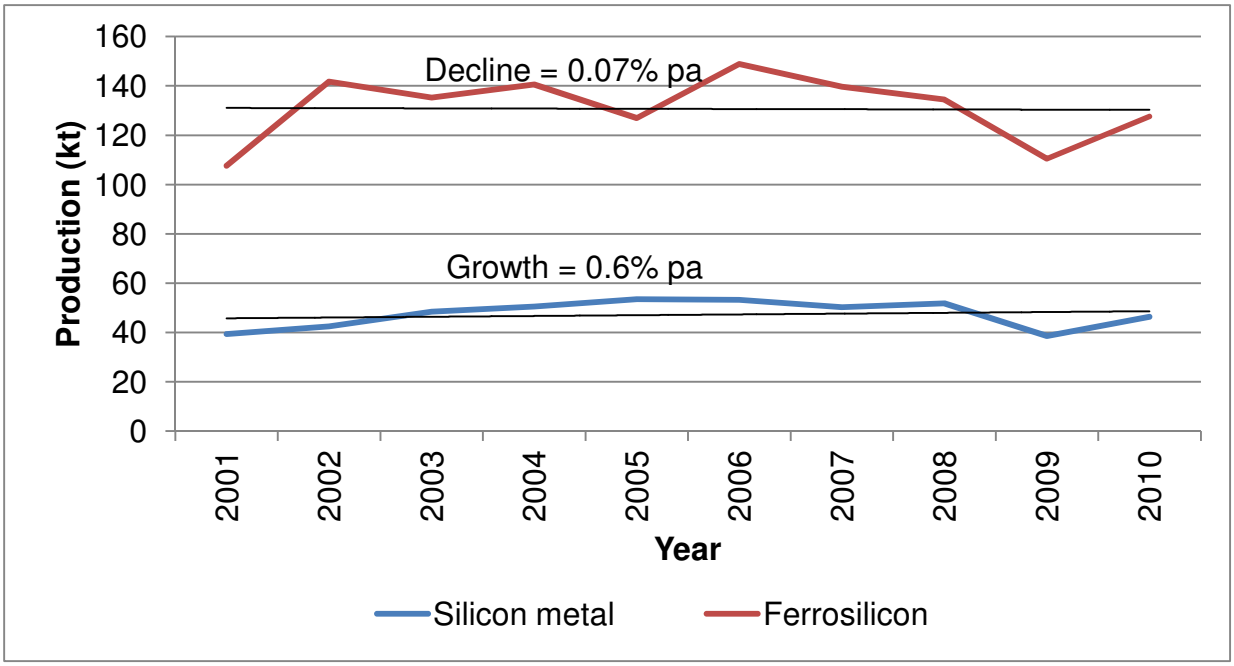
The production of aluminium-silicon alloys accounts for 55 percent of the world's metallurgical grade silicon metal consumption. Aluminium-silicon alloy is a high efficiency deoxidizer that is used instead of pure aluminium when making steel. The second largest application of silicon metal is the chemical industry, which accounts for 40 percent of world consumption. Pure silicon metal, which represents the remaining 5 percent of consumption, is used to produce ultra-pure silicon wafers used in the semiconductor industry, electronics and in photovoltaic applications.

Ferrosilicon is used mainly in steel making and foundries, as a source of silicon in the production of carbon steels, stainless steels, and other ferrous alloys for its deoxidizing properties, to prevent loss of carbon from the molten steel.

4.1. South Africa's Supply of Silicon Alloys

South Africa's silicon metal production grew at an average rate of 0.6 percent, from 39.4 kt in 2001 to 46.4 kt in 2010 (Fig. 6). The country went from contributing 4.9 percent in 2001 to 2.5 percent in 2010 to the world's silicon metal production, due to lack of development in the industry. Silicon metal production reached its highest volume of 53.5 kt in 2005 due to higher demand from the aluminium and solar markets. The global economic crisis resulted in a 25.5 percent decline in silicon metal production in 2009. However, silicon metal production increased by 20.3 percent in 2010 driven by higher demand from the chemical and aluminium industries.

FIGURE 6: SOUTH AFRICA'S PRODUCTION OF SILICON ALLOYS, 2001-2010



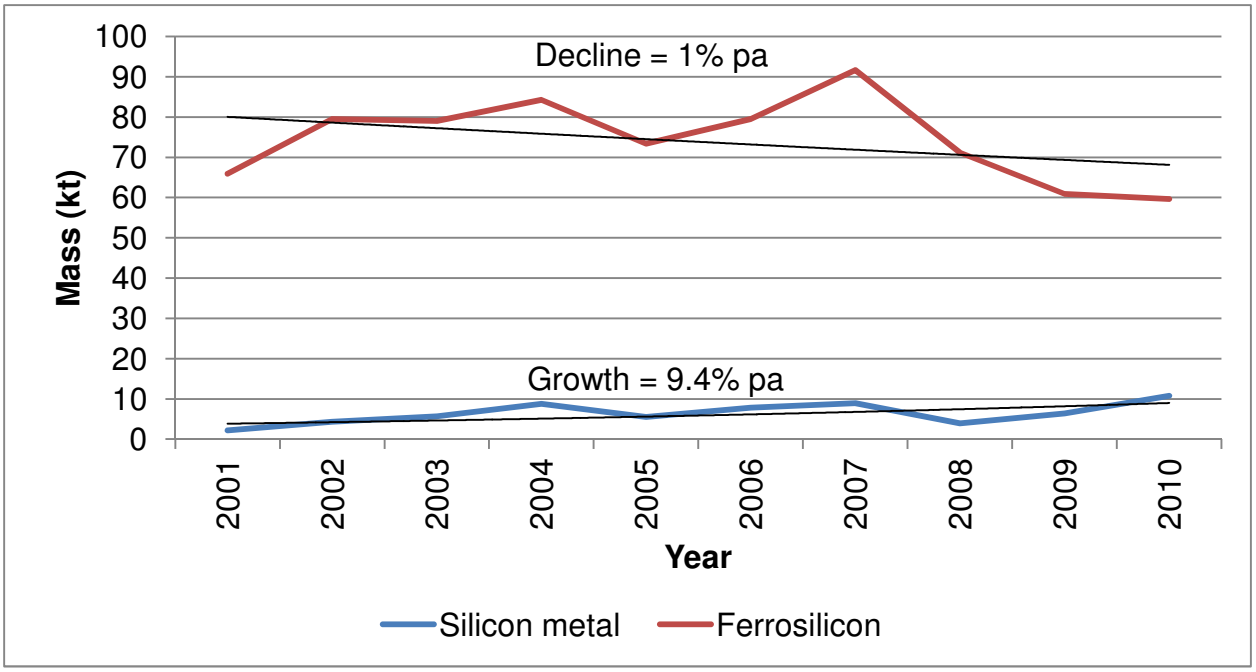
Source: DMR, Directorate Mineral Economics

Ferrosilicon production declined by a marginal average annual rate of 0.07 percent, from 107.6 kt in 2001 to 127.5 kt in 2010 (Fig. 6). South Africa's contribution to the world's ferrosilicon production declined from 4.1 percent in 2001 to 2.4 percent in 2010. The country saw the biggest increase in ferrosilicon production by 32 percent in 2002 due to higher demand from the steel industry. Production declined by 18 percent in 2009 due to lower demand resulting from the global economic crisis but, increased by 15.5 percent in 2010.

4.2. South Africa's Demand of Silicon Alloys

Local sales mass of silicon metal grew at an average rate of 9.4 percent per annum, from 2.2 kt in 2001 to 10.8 kt in 2010 (Fig. 7). The sales mass declined by 38 percent and 59 percent in 2005 and 2008, respectively, due to lower demand. The biggest local sales mass increases occurred in 2002, when a 95 percent growth rate was recorded relative to 2001 and in 2009, when local sales volumes rose by 64 percent. Local sales mass of silicon metal grew further by 68.8 percent in 2010, due to higher demand.

FIGURE 7: SOUTH AFRICA'S LOCAL SALES OF SILICON ALLOYS, 2001-2010

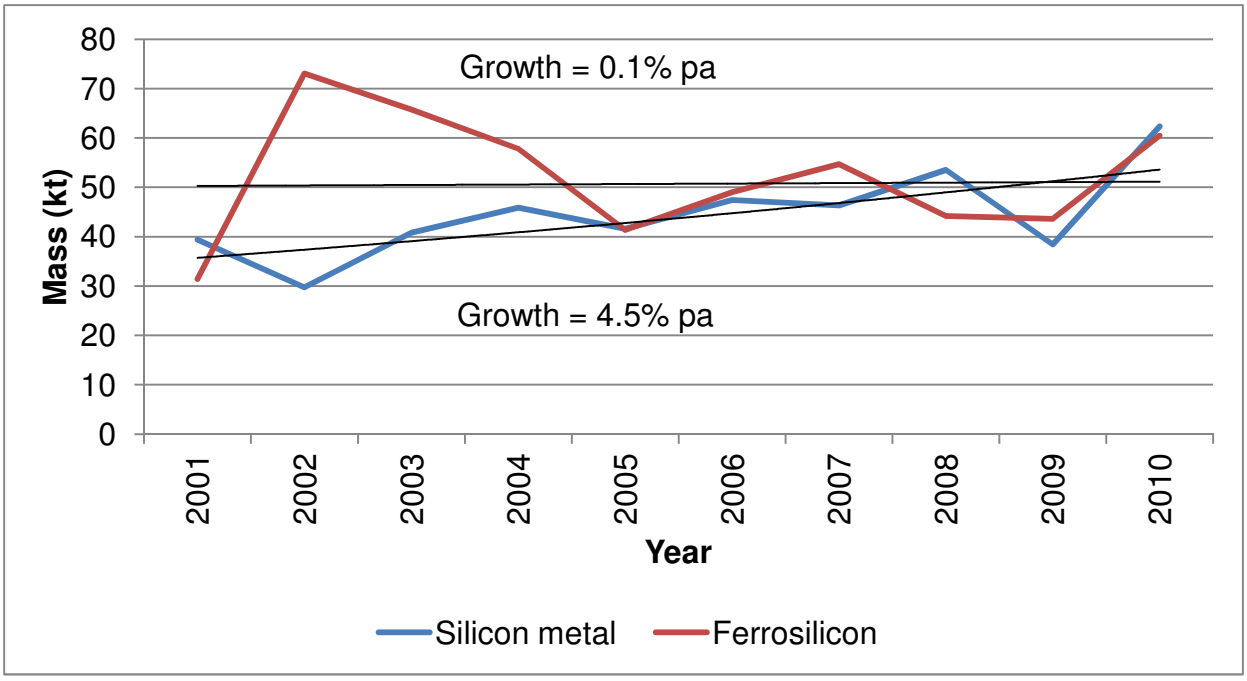


Source: DMR, Directorate Mineral Economics

Local sales volumes of ferrosilicon declined at an average rate of 1 percent per annum, from 65.9 kt in 2001 to 59.6 kt in 2010 (Fig. 7). The biggest decline was by 22 percent in 2008 compared with 2007, followed by a further 14 percent decline in 2009, due to lower domestic demand. Local sales mass of ferrosilicon decline by a further 2.1 percent in 2010.

Export sales volumes of silicon metal grew at an average annual rate of 4.5 percent from 39.4 kt in 2001 to 62.4 kt in 2010 (Fig. 8). The 25 percent decline in 2002 was due to the economic recession in the US. The biggest decrease that followed during this period was by 28.2 percent in 2009 due to a weaker demand resulting from the global economic crisis. However, export sales mass increased by 62.4 percent in 2010 driven by the recovery in the demand market.

FIGURE 8: SOUTH AFRICA'S EXPORT SALES OF SILICON ALLOYS, 2001 -2010



Source: DMR, Directorate Mineral Economics

Ferrosilicon export sales volumes increased by an average of 0.1 percent annually, from 31.4 kt in 2001 to 60.5 kt in 2010 (Fig. 8). The export sales mass increased by 132 percent to reach a peak of 73 kt in 2002 compared with 2001. This increase was followed by a three year decline of export sales mass to 2005. The sales mass increased by 19 percent in 2006 and a further 12 percent in 2007, driven by the commodity boom. Export sales mass of ferrosilicon declined by 19 percent in 2008, followed by a 1.4 percent decline in 2009 due to lower demand driven by the global economic crisis. However, export sales mass increased by 38.6 percent in 2010.

5. VANADIUM ALLOYS

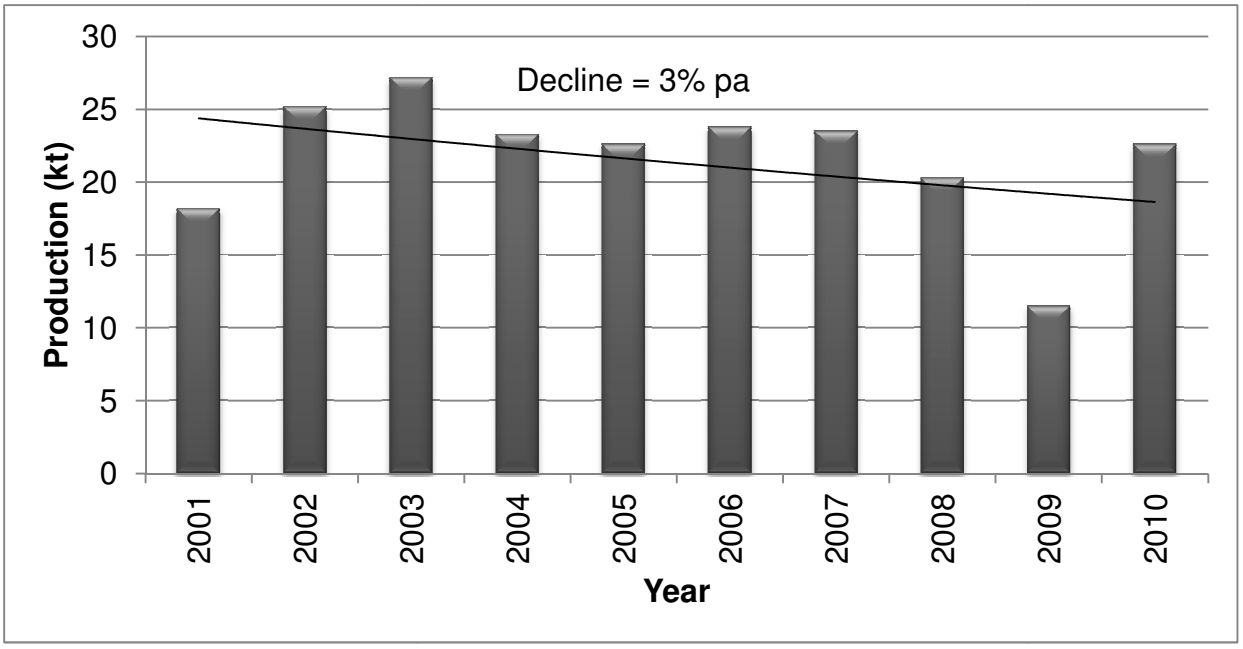
Metallic vanadium is not found in nature, but is known to exist in about 65 different minerals. In South Africa, the bulk of vanadium is hosted in the titani-ferrous magnetite deposits and is recovered by salt-roasting and leaching process. Briefly, the ore, slag or concentrate, is blended with sodium salt and then roasted. Sodium reacts with vanadium forming a water soluble sodium vanadate which is then treated with ammonia to precipitate insoluble ammonia vanadate. The ammonia vanadate is calcined driving off ammonia and leaving a residue of vanadium pentoxide (V_2O_5). Ferrovanadium (FeV) is produced by first reducing V_2O_5 to vanadium trioxide (V_2O_3) and then reacting this with iron and aluminium to produce FeV.

Vanadium demand is largely driven by steel manufacturing industry where more than 90 percent of global vanadium production is consumed as ferrovanadium, to impart strength and toughness to the steel. About 5 percent of vanadium is used in the production of aluminium master alloys which are used in the production of titanium alloys. The balance is used in other applications including energy preservation.

5.1. South Africa's Supply of Vanadium Alloys

South Africa's production of vanadium declined at an annual average rate of 3 percent, from 18.2 kt in 2001 to 22.6 kt in 2010 (Fig. 9) and went from contributing 57.9 percent in 2001 to 38 percent in 2010 to the world's vanadium output. Vanadium production reached its highest at 27.2 kt in 2003, 7.9 percent higher compared with the preceding year. However, this was followed by a downward spiral until 2009, which had the highest decline at 43 percent compared with 2008. The poor conditions were due to plant closure, high inventory levels accumulated in the previous years and weaker demand from the steel industry. However, production increased by 57 percent in 2010 due to higher demand from the steel industry.

FIGURE 9: SOUTH AFRICA'S PRODUCTION OF VANADIUM ALLOYS, 2001-2010

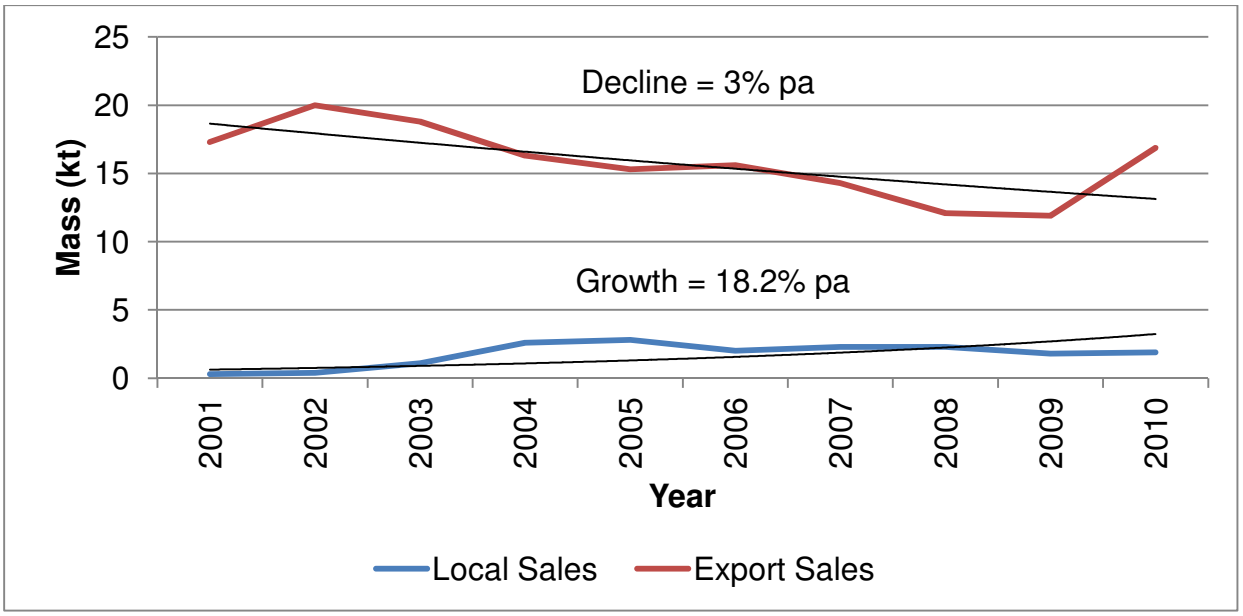


Source: DMR, Directorate Mineral Economics

5.2. South Africa's Demand of Vanadium Alloys

Local sales volumes of vanadium grew at an average rate of 18.2 percent annually, from 0.3 kt in 2001 to 1.9 kt in 2010 (Fig. 10). Major growth was by 175 percent to 1.1 kt in 2003, followed by a 136 percent increase to 2.6 kt in 2004, driven by higher demand. A peak of 2.8 kt was reached in 2005, an increase of 7.7 percent compared with 2004. However, local sales volumes declined by 28.6 percent in 2006. A decline of 21.7 percent was also seen in 2009, compared with the previous year due to lower demand. Local sales mass increased by 4.8 percent in 2010.

FIGURE 10: SOUTH AFRICA'S LOCAL AND EXPORT SALES OF VANADIUM ALLOYS, 2001-2010



Source: DMR, Directorate Mineral Economics

Export sales volumes of vanadium declined by an annual average rate of 3 percent from 17.3 kt in 2001 to 16.9 kt in 2010 (Fig. 10). Export volumes peaked at 20 kt in 2002 due to higher demand from the steel market and declined for the rest of the study period. The biggest drop was by 15.4 percent in 2008, followed by a further 1.7 percent decline in 2009, due to poor economic conditions. However, export sales mass increased by 41.9 percent in 2010.

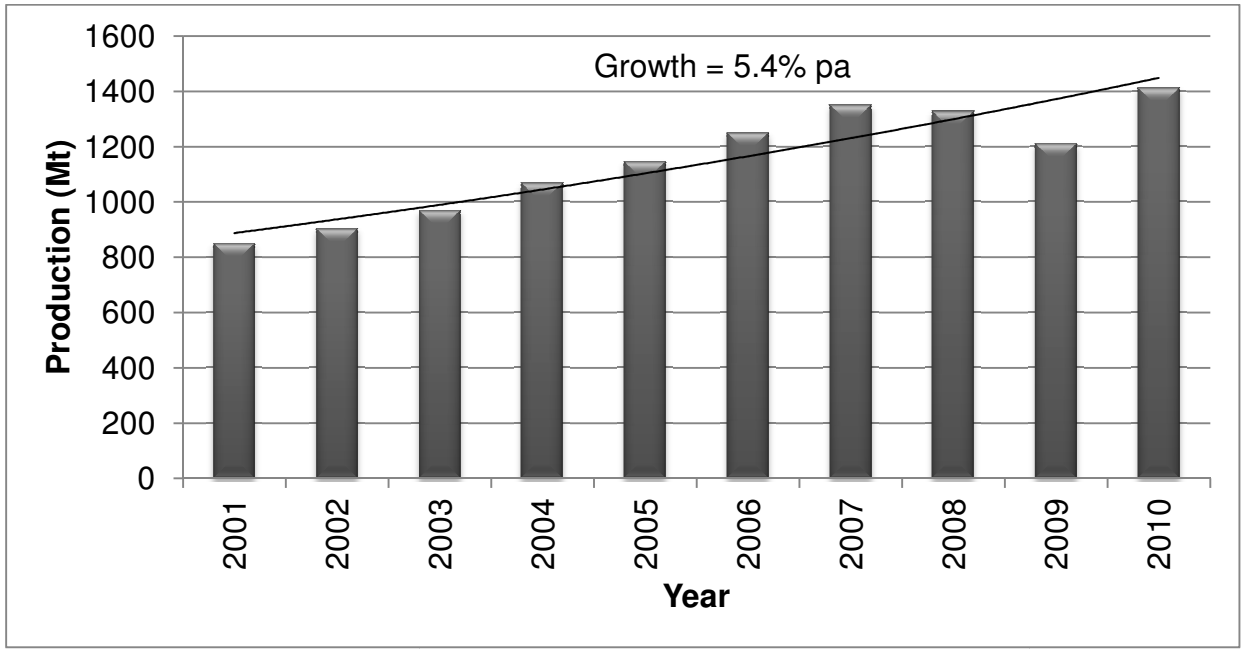
6. FERROALLOYS DEMAND MARKETS

On average, crude steel production consumes over 90 percent of ferroalloys with ferrochrome consumed mainly in stainless steel production. Therefore, the demand for these commodities is highly dependent on the international steel market.

6.1. Crude Steel

World steel output grew at an average rate of 5.4 percent annually, from 850 Mt in 2001 to 1 414 Mt in 2010 (Fig. 11). World production decreased by 1.6 percent to 1 329 Mt in 2008 compared with 2007, a first decline during the ten year study period, followed by a further 8.9 percent decline in 2009, due to lower demand driven by the global economic crisis. However, production increased by 16.7 percent in 2010 driven by the recovery in the global economy.

FIGURE 11: WORLD CRUDE STEEL PRODUCTION, 2001-2010



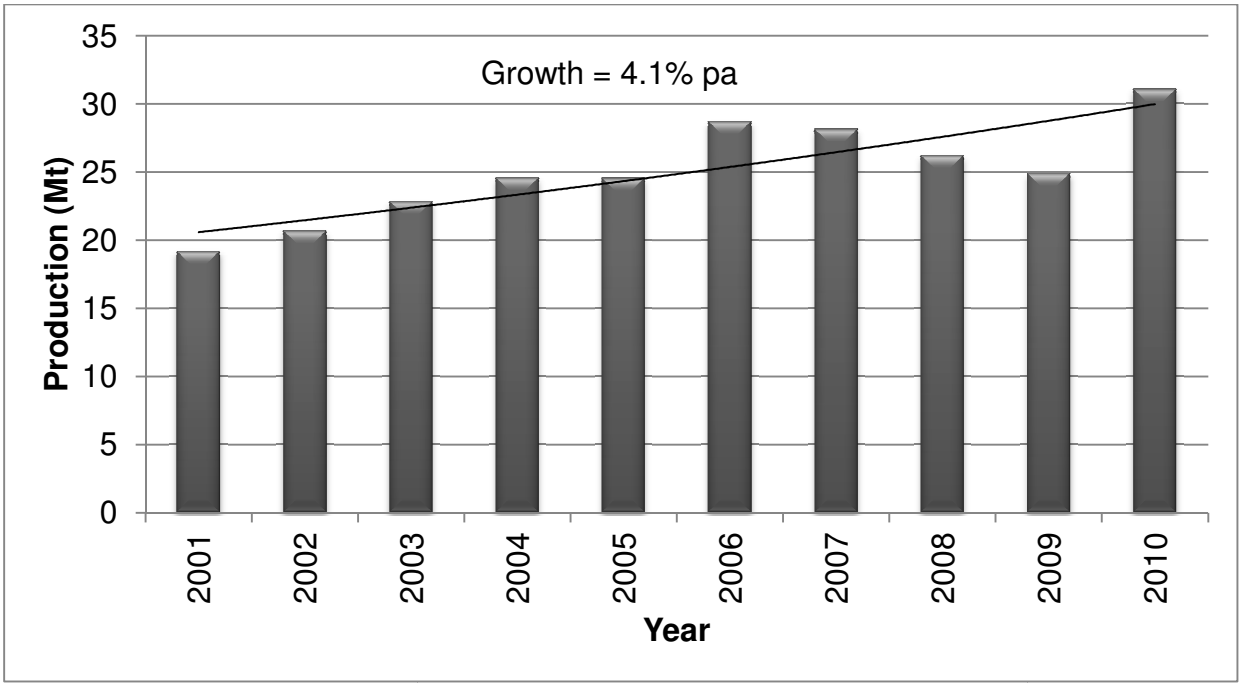
Source: Worldsteel Association

South Africa's steel production has had a stagnant annual growth rate during the ten year study period and went from contributing 1 percent in 2001 to 0.6 percent in 2010 to the world's steel production.

6.2. Stainless Steel

World stainless steel output grew annually by an average of 4.1 percent, from 19.2 Mt in 2001 to 31.1 Mt in 2010 (Fig. 12). Production reached 28.7 Mt in 2006, driven by higher demand from China, by means of new capacity which came on-stream during 2006. However, production declined by 2 percent, 6.8 percent and 5 percent during 2007, 2008 and 2009, respectively, driven by stock cycles and global economic crisis. The 25 percent increase experienced in 2010 set a new record in the world stainless steel production driven by economic recovery, higher end-use demand, restocking by fabricators and also the refilling of the internal supply chain in the stainless steel mills. South Africa's stainless steel production contributed less than 1 percent to the world's stainless steel output during the period under study.

FIGURE 12: WORLD STAINLESS STEEL PRODUCTION, 2001-2010



Source: International Stainless Steel Forum

7. OUTLOOK

The Worldsteel Association forecasts that world steel demand will grow by 5.4 percent in 2012. It is also reported that steel output is expected to reach 1.8 Bt in 2015. South Africa, as a leading producer of ferrochrome and vanadium alloys and a major supplier of manganese alloys as well as a small silicon alloys producer, is likely to be positively affected by the optimistic international conditions.

8. THE ROLE OF SOUTH AFRICA'S LEGISLATION

Steel use in any country is closely linked to its economy and therefore serves as one of the indicators for economic development, with the largest consumption being in major developing countries of the world. South Africa's steel consumption per capita, which averaged 101 kg per person, 53 percent lower than the world average of 190 kg per person, grew at an average rate of 1 percent annually from 2001 to 2010. The country has also been experiencing infrastructural constraints, which have restricted growth in the ferroalloys industry over the last decade. These factors signify lack of developments in the country.

However, the South African government has adopted industrial policies, including Industrial Policy Acton Plan 2010/11 (IPAP2) and the New Growth Plan (NGP), which are set to address constraints in infrastructure by expanding railway tracks and increasing port capacities.

The second Integrated Resource Plan for electricity (IRP2) foresees an almost double electricity capacity by 2030, with 33 percent of new generation coming from renewable sources and 25 percent from nuclear power.

These policies also prioritise the mining value chain, which include mineral beneficiation. The Beneficiation Strategy which provides a framework for value addition, has, as one of its strategic value chains, steel and stainless steel manufacturing and the government is working on creating an enabling environment for the development of processing plants in the country. This could raise local demand and production for ferrous alloys as well as present investment opportunities to expand capacity in the country.

9. CONCLUSION

South Africa's total ferrous alloys production grew at an average rate of 1.8 percent annually, from 2001 to 2010. Production grew during the first half of the study period driven by the emerging Chinese demand. The second half of the period experienced a downturn in the average rate of production, despite the commodity boom in 2007. The global economic crisis had the worst effect on the industry, which saw South Africa's total ferroalloys production declining by 11.6 percent and 31.5 percent in 2008 and 2009, respectively. However, the recovery in the global steel market during 2010 drove the recovery of South Africa's ferroalloys market.

Ferrous alloys production was dominated by ferrochrome, which production grew at an annual rate of 3.6 percent. Silicon alloys production had an average growth rate of 0.1 percent annually. However, manganese and vanadium alloys production declined at average rates of 4 percent and 3 percent, respectively, during the same period.

10. REFERENCES

1. A Beneficiation Strategy for the Mineral Industry of South Africa, June 2011
2. An Overview of South Africa's Vanadium Industry During The Period 1997-2006
3. DMR, Directorate Mineral Economics, 2000-2009, SAMI
4. South African Ferrous Minerals Production Trends, 1994-2003, Directorate Mineral Economics
5. South Africa's Silicon Industry Developments, 2000-2009, Directorate Mineral Economics
6. US Geological Survey, 2009-2010, Mineral Commodity Summaries
7. Wikipedia. http://en.wikipedia.org
8. World Steel Association, www.worldsteel.org