AN OVERVIEW OF CURRENT MANGANESE AND CHROMIUM FERROALLOY PRODUCTION IN RUSSIA

L.A. Smirnov, V.I. Zhuchkov, E I. Arzamastsev and A.A. Babenko

Ural Institute of Metals, Ekaterinburg, Russia. E-mail: uim@ural.ru

ABSTRACT

A brief analysis is given for state-of-the-art of manganese and chromium ferroalloy production in Russia and their consumption by metallurgy plants. The main causes of low output of manganese and chromium ferroalloys, and ways to resolve the issue of ferroalloy production development are considered.

1. INTRODUCTION

The state of ferroalloy production in Russia is defined by the output and stock of steel produced, as well as domestic and foreign market opportunities.

At present the capacity for all kinds of ferroalloys produced is estimated as 24,000 kt annually. At 16,000 – 18,000 kt manganese ferroalloys make up 41% of the output and the chromium ferroalloys make up 29% [1].

Steel production is characterized by fluctuation, with average annual steel production predicted to increase by 0.52% per annum. 715,000 kt of steel was produced in the world in 1980, 770,000 kt in 1990 and 830,000 kt in 2000. It is predicted that 861,000 kt of steel will be produced in the year 2005. In 2000 China ranked first in production in the world (125,800 kt in 2000), Japan was second (106,400 kt) and the USA third with 101,000 kt [2].

Under the conditions of the deep economic crisis In Russia, steel output decreased by 43% compared to 1990, reaching 59,000 kt at the end of year 2000. At the same time, the production of alloyed and special steels and super alloys was also reduced. The output of corrosion-resistant steel, for instance, was reduced by 75% and the ferroalloy production decreased by 53%. Only the expansion of export to CIS countries, avoided the further fall of ferroalloy production in this country.

2. FERROALLOY PRODUCTION

Ferroalloy production in Russia is represented by four specialized plants (Chelyabisk Electrometallurgy Plant, Serov Ferroalloy Works, Kuznetskie Ferrosplavy and the Klyuchevskoi Ferroalloy Plant), and a range of affiliated ferroalloy shops and iron and steel plants. The production capacities of these producers can assure an output of up to 1,650 kt of ferroalloys a year.

During the middle 90's, the total ferroalloy output level was stabilized at 800 kt, and in recent years it amounted to 1,200 kt a year. The production capacities in 2000 amounted to 70% of that of 1990, this corresponds to similar indexes in other countries [2].

2.1 Manganese Ferroalloys

The supply of manganese ore to the Russian ferrous-metallurgy industry is crucial. For a long time, iron and steel plants in Russia consumed manganese products from Ukraine and Georgia.

Russia's own manganese-ore reserve was not utilized and production capacity for manganese ferroalloy production was not present. The estimated reserve of manganese ore, of 146,000 kt, has stayed the same for a long period. Russia's general manganese reserve ranks ninth in the world.

Of the entire range of manganese alloys, only about 0,28 Mt of ferromanganese is produced within Russian territory in the blast furnaces of the Kosogorsky Metallurgy Plant, from material imported from Ukraine. All other manganese ferroalloys (~1,125,000 kt) consumed, were manufactured at Ukrainian and Georgian plants. No silicomanganese, EAF ferromanganese and metallic manganese are produced in Russia.

At the moment, blast-furnace ferromanganese and silicomanganese is produced, in Russia. The major producer of blast-furnace ferromanganese is Kosogorsky Metallurgy Plant.

Before the middle of 2002, blast-furnace ferromanganese was melted at Alapayevsk Metallurgy Plant, but due to unprofitability its production was terminated. Starting in November 2002, the melting of blast-furnace ferromanganese has been implemented at Satka Iron Plant with a monthly output of some 45 kt.

The total annual production capacity of blast-furnace ferromanganese in the mentioned plants is about 350 000 t, this satisfies the demand as long as raw material is available.

Silicomanganese production at Chelyabinsk Iron and Steel Plant and Serov Ferroalloy Works, from manganese-ore imported from Kazakhstan amounts to 120 kt - 150 kt annually.

The balance of manganese ferroalloy production and consumption is shown in the following table. Following a fall in 1996-1997, the growth of manganese ferroalloy production and consumption in this country is marked. The supply and consumption of ferromanganese in the domestic market rose 1.3 times, and increased 1.97 times for silicomanganese.

Table 1. Balance of income and distribution of the manganese ferroalloys in Russia (in kt).

Indexes	1995	1996	1997	1998	1999	2000
Production						
Ferromanganese	82.3	66.3	47.1	78.8	138.3	84.5
Silicomanganese	0	0	0	32.8	123.2	122.8
Total	**82.3**	**66.3**	**47.1**	**111.6**	**261.5**	**207.3**
Imports						
Ferromanganese	155.1	125.8	144.6	150.4	105.3	162.1
Silicomanganese	264.0	210.7	154.6	114.6	121.3	190.0
Total	**419.1**	**336.5**	**299.2**	**265.0**	**226.6**	**352.1**
Exports						
Ferromanganese	9.3	2.9	3.6	6.2	1.9	3.1
Silicomanganese	0	0	0	4.6	6.2	8.2
Total	**9.3**	**2.9**	**3.6**	**10.8**	**8.1**	**11.3**
Domestic market supplies						
Ferromanganese	228.1	189.2	186.2	223.0	241.7	243.5
Silicomanganese	264.0	210.7	154.6	142.8	238.3	304.6
Total	**492.1**	**399.9**	**342.8**	**365.8**	**480.0**	**548.1**

Despite the growth in manganese ferroalloy output, the demand for carbon ferromanganese and silicomanganese at iron and steel plants is still only 62% satisfied and the demand for medium- and low-carbon ferromanganese is fully covered by imports, mainly from Ukraine.

The current demand of between 520 kt and 690 kt per annum for manganese ferroalloys could be met by free capacities at operating plants but is held back by the absence of our own manganese ore base.

There are more than 20 deposits of manganese ore in Russia, total reserves are estimated at 367,100 kt. Unfortunately ores that are difficult to concentrate predominate and make up about 68% (208,000 kt) . The rest is represented by oxide phosphoric ores – 77,000 kt (25%) and only 7% are ores easy to concentrate.

In general the raw-material mineral base for manganese is distinctively of low quality. The ores are characterised by a 0.3-0.6% phosphorous content and having a manganese content as much as 20%. Commercialisation of these deposits demand substantial investments and the development of efficient beneficiation techniques.

Therefore, for Russia today, the crucial problems are still the establishment of our own manganese-ore base and retention of integral links with the CIS and foreign countries for raw-material supplies. The availability of unused capacities will allow increase of ferroalloy production if the problems of supply of ore can be solved.

2.2 Chromium Ferroalloys

Ferrochromium is the second largest ferroalloy based on its annual production output, and no problems with its production occurred in Russia until recent years.

Production capacities, concentrated at Serov Ferroalloy Works, Chelyabinsk Electrometallurgy Plant and the Klyuchevskoi Ferroalloy Plant, satisfied internal demands completely and enabled a substantial export. However, the domestic raw-material market was poorly developed.

Ferrochromium production was based on processing chromium ores supplied by the Donskoi Mining Facility in the Republic of Kazakhstan, and only a minor part of the ore material used was from the Saranovskoye deposit in the Perm region, due to its low quality. Only about 5% was added to charges of Donskoi ore.

After the breakdown of the USSR, starting from 1994, the situation in the chromium raw-material market has drastically changed for the worse in Russia. Kazakhstan has raised its own chromite consumption and extended domestic capacities on ferrochrome production by a factor of 2.0-2.5. It reduced the supplies of chromite ores to Russia and increased of the prices for lump ore by 2 to 3 times. This resulted in a reduction of chromium ferroalloy production from 450 kt in 1990 to 168 kt in 1998. Only after Russia entered the foreign market of chromium material (Turkey), ferrochrome production began to grow, reaching 240 kt in the year 2000.

Nowadays the situation with chromium is the same as with manganese, and there are two ways of resolving the situation. Either to orientate the ferrochrome producers only to the foreign raw material market, thereby allowing a recurrence of the 1994-1995 situation, or follow the way of development of our own raw-mineral base, preserving integral links with the CIS and foreign countries on reciprocal terms.

For now we possess the ability to form our own ore base. Predicted reserves of chromite ores were 680,000 kt in the early 90's. Starting from 1993, exploration work commenced in the most promising areas of Russia: the: Murmansk , Karelia, Yamalo-Nenetsky , Tyumen , Komi, Urals, and the West and East Siberian regions.

The following ore bodies have been discovered:

- In the Murmansk region the Sopcheozerskoye deposit has been explored and preliminarily estimated: with reserve of 5,300 kt of chromite ores with an average Cr_2O_3 content of 25%;
- The Aganozerskoye deposit in Karelia with preliminarily estimated reserve and reserve base of 212,000 kt having average Cr_2O_3 content of 22-23%;
- Rai-Iz massif deposit in Yamalo-Nenetsky Autonomous Region, having general geological reserves estimated at 237,000 kt with average Cr_2O_3 content up to 50% The quality of Rai-Iz chromites is not inferior to that of Donskoi ores [4].

Commercial exploration of the deposits has been started by Yamal Mining Co., on whose request we did a complex study in 2001 on the most efficient technology for ferrochromium production of the Western deposit concentrates of the Rai-Iz massif.

At present, Yamal Mining Co. is engaged in solving the problems related to organizing ore beneficiation and the foundation of industrial infrastructure for mining and transporting the concentrated ore to ferroalloy plants.

Commercialisation of Rai-Iz massif deposits solves the problem of domestic chromium raw materials supply to ferroalloy plants.

3. CONCLUSIONS

Nowadays for Russia, the increase of manganese ferroalloy production and reduction of their import is only possible under conditions of established own manganese ore base, preserving the integration links with foreign and former-USSR countries for raw material supply.

In a chromium sub-branch, a commercialisation of Rai-Iz massif deposits can completely resolve the issue of ferroalloy plants supply with domestic chromium ore.

4. REFERENCES

[1] V. Dashevski and V. Zhuchkov, "Na rynke ferrosplavnogo proizvodstva lidery ne menyayutsya [The Leaders of the Ferroalloy Market Are Not Changed]", Eurasian Metals, 2002. No. 5, pp. 34-36.

[2] M. Gasik, O. Gantserowski and A. Ovcharuk et al., "Ferrosplavy Ukrainy – 2000, [Ferroalloys of Ukraine – 2000]", Dniepropetrovsk: Sistemnyie tekhnologii, 2001. p. 141.

[3] G. Serov and V. Zhuchkov, "Otsenka proizvodstva i potrebleniya ferrosplavov v Rossiiskoi Federatsii, [The Assessment of Ferroalloy Production and Consumption in Russian Federation]", Stal', 2001. No. 6., pp. 64-67.

[4] V. Chernobrovin, G. Mikhailov and A. Khan et al., "Sostoyanie i perspektivy proizvodstva khromistykh splavov v usloviyakh Chelyabinskogo elektrometallurgicheskogo kombinata, [State-of-the-Art and Prospects for Chromium Alloy Production at Chelyabinsk Electrometallurgy Plant]", Chelyabinsk, 1997. p. 224.