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FERROALLOY INDUSTRY IN CIS COUNTRIES

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ABSTRACT

Ferroalloys production on the territory of the former USSR and forecast for the nearest future.

THE SITUATION BEFORE THE USSR DISINTEGRATION

The ferroalloy capacities of the USSR (exceeding 6 mln. tpy) were in complete compliance with the demand of the industry. Out of the total output of commodity ferroalloys approaching 5.4 mln. MT in 1990 the steel industry consumed 80%, machine-building 12% and about 8% were exported. Ferroalloys were produced at ten special plants and in some shops of steel plants belonging to the steel industry of the country. The production of nickel, ferronickel, silica was traditionally related to non-ferrous industry and is not discussed in the paper. The concentration of ferroalloy industry in Russia, Ukraine, Kazakhstan and Georgia was generally conditioned by the location of the plants near the raw materials and power sources (Table 1).

Table 1.Ferroalloys Production in the Former Republics of the USSR(%)

COUNTRY	SILICON	MANGANESE	CHROMIUM	OTHERS	TOTAL
Russia	35.5	10.9	57.0	100.0	32.2
Ukraine	29.0	67.8	-	-	36.3
Kazakhstan	35.5	-	43.0	-	22.1
Georgia	-	21.3	-	-	8.4
Total	100.0	100.0	100.0	100.0	100.0

There were practically no problems with energy supply in conditions of the unified power system in the USSR. The ferroalloys' production in the USSR was completely supported by local raw materials, excluding tungsten and molybdenum concentrates which were imported. The country imported as well up to 200,000 MT of low phosphorous manganese ore concentrate basically for the production of medium carbon ferromanganese.

The ferroalloy industry in the USSR operated more than 200 electric furnaces of the unit capacity from 2 to 75 MVA. Their total power consumption was approaching 26 billion KWh

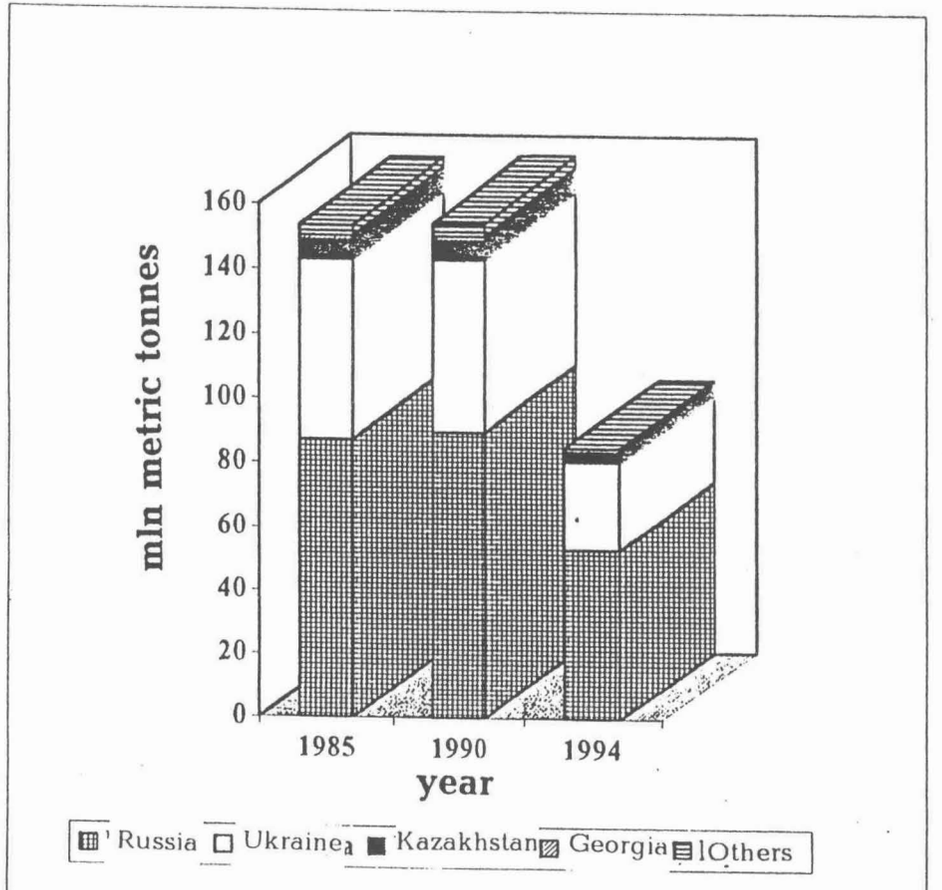

Fig.1. Crude steel production in the countries of the former USSR

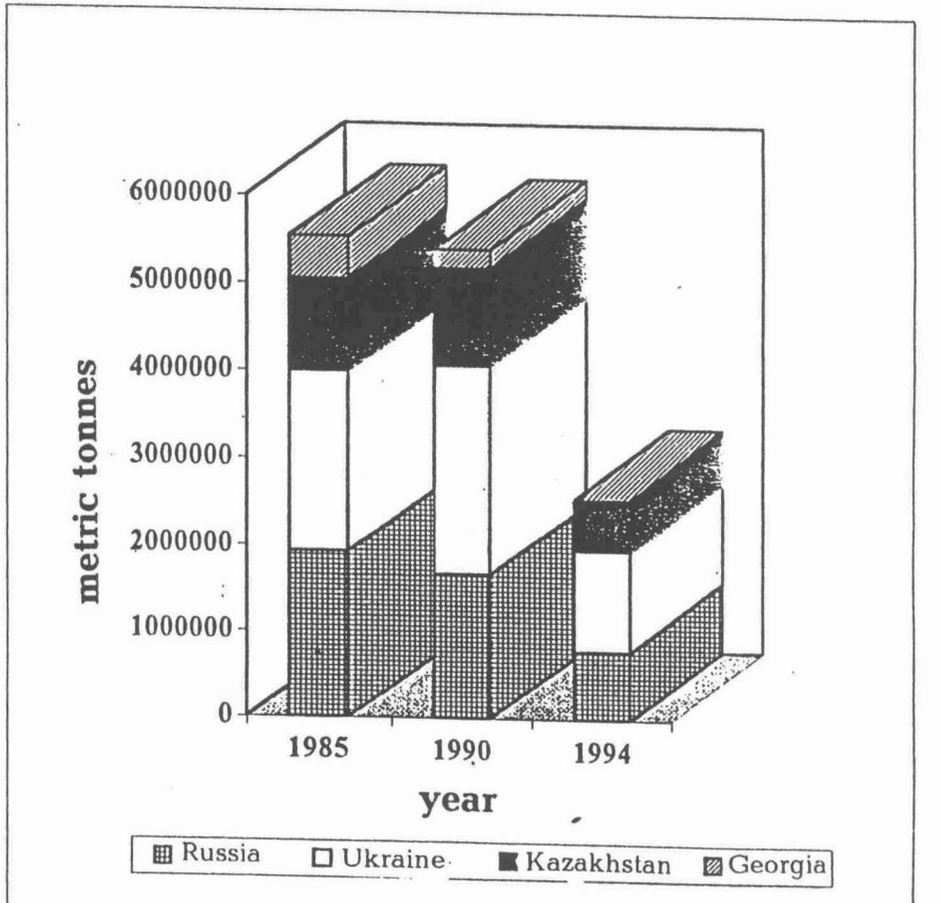

Fig.2. Production of commodity ferroalloys in Russia, Ukraine, Georgia and Kazakhstan

TABLE 2
CIS FERROALLOYS PLANTS

Country, plant, location	**Number of electric furnaces**	**Furnace transformers' capacity, MVA**	**Products**
Russia			
JSC Kuznetskie ferrosplavy, Novokuznetsk	13	16.5–32	20–75% FeSi complex alloys
JSC Chelyabinsky electrometallurgical works, Chelyabinsk	36	3.5–33	LC,HC FeCr 20–90% FeSi 15–28% SiCa 55–60% FeMo 65–70% FeW FeSiCr alloys and alloying compositions
JSC Serovsky ferroalloys plant, Serov	18	5–16.5	LC, HC, MC FeCr FeSiCr
JSC Klyuchevsky ferroalloys plant, Dvurechensk	7	3–5.5	LC, HC FeCr 15% SiCa 30% FeTi FeNb, FeW 98% Cr alloys and alloying compositions
NIIM pilot shop, Chelyabinsk	5	3–5.5	LC FeCr 15–28% SiCa
Ferroalloys shop at the Novolipetsk steel works, Lipetsk	2	10–12	65% FeSi 30% FeTi 6–20% FeB
Ferroalloys shop, Tula	2	3–5	40–50% FeV chrome metal, 98%
Ferroalloys shop at the Chusovskoy steel works	2	2.5	40–50% FeV

Country, plant, location	Number of electric furnaces	Furnace transformers ' capacity, MVA	Products
Kazakhstan			
Yermakovsky ferroalloys works, Yermak	27	16.5—63	25—90% FeSi FeSiCr FeSi HC complex alloys and alloying compositions
Aktyubinsky ferroalloys plant, Aktyubinsk	18	3—24	FeSiCr LC, MC, HC FeCr complex alloys and alloying compositions
Ukraine			
Nikopolsky ferroalloys plant, Nikopol	16	22—75	82% SiMn 76% FeMn
Zaporozhsky ferroalloys plant, Zaporozhye	29	5—32	20—65% FeSi 82% SiMn 80% FeMn manganese metal, 90%
Stakhanovsky ferroalloys works	8	24—32	20—90% Fe Si complex alloys and alloying compositions
Georgia			
Zestafonsky ferroalloys works, Zestafoni	22	3—75	82% SiMn 76% FeMn 80% FeMn 90% Mn electrolitic

Table 3

Ferroalloys output (,000 metric tonnes)

	CIS total			INCLUDING							
				RUSSIA		UKRAINE		KAZAKHSTAN		GEORGIA	
	1990	1994	1994/1990 * 100%	1990	1994	1990	1994	1990	1994 г.	1990	1994
Total ferroalloys output	6040.7	2800.1	46.4	1990.8	971.0	2415.2	1176.9	1333.6	625.7	301.1	26.5
Incl. commodity ferroalloys	5395.2	2562.7	47.5	1675.3	799.9	2389.6	1162.6	1117.4	581.2	212.9	19.0
Commodity ferro alloys breakdown											
— silicon	1917.3	845.8	44.1	633.3	360.7	594.1	277.4	689.9	207.7	0.0	0.0
— chrome	900.2	640.2	71.1	481.8	313.8	2.0	0.0	416.4	326.4	0.0	0.0
— manganese	2278.9	1003.9	44.1	280.6	55.3	1785.4	885.0	0.0	44.6	212.9	19.0
other ferroalloys	298.8	72.8	24.4	279.6	70.1	8.1	0.2	11.1	2.5	0.0	0.0

(26 TWH). A brief description of the production capacities at the major ferroalloys plants is given in Table 2.

In conditions of a deep economic crisis the total production of crude steel in CIS fell by 45% in 1994 compared to 1990 (Fig. 1) with a steeper decline in production of alloy steels, special steels and alloys. Thus the production of rolled products from stainless steels slumped by 75%. In the same period the total production of ferroalloys in CIS fell by approximately 53%, including Russia and Ukraine by 51%, in Kazakhstan by 53% and Georgia by 91% (Fig. 2, Table 3). A deeper fall in ferroalloys output was prevented due to larger volumes of exports outside CIS both from Russia and to a greater extent from Kazakhstan and the Ukraine. The situation will become quite clear if we take into consideration the fact, that the Ukraine consumed about 45% of the total output for its own needs, Kazakhstan and Georgia less than 4% and, on the contrary, about one half of Russia's demand was covered by supplies from the other republics.

After the disintegration of the USSR as a result of the deep economic crisis all the ferroalloys producers in CIS faced the problem of selling their products that earlier had not existed in the planned economy. Hence competitiveness in the market was selected as the major approach by the CIS ferroalloys plants to their activities after the USSR disintegration and as a condition for their economic survival. It should be specially stressed that now the ferroalloys plants practically have no government support. All the ferroalloys plants in Russia have been converted into joint stock companies, and the Government's share in their equity is either not present or is insignificant. In the nearest future the privatisation of plants in the other CIS states is also predicted. At the same time the problems that various ferroalloys plants face have their own specific features.

RUSSIA

The consumption of ferroalloys in Russia in 1994 is given in Table 4.

Table 4. Ferroalloys Consumption in Russia (,000 MT)

	MANGANESE ALLOYS	SILICON ALLOYS	CHROME ALLOYS	OTHER FERRO-ALLOYS	TOTAL
Consumption	392	326	123	12	853
Including import	360	139	20	-	519

Domestic production of ferroalloys in Russia and their import from the CIS countries provided conditions for the production of crude steel at about 50 mln MT. Manganese alloys, purchased mainly from the Ukraine, take about 70% share in the total import of ferroalloys to Russia. This is due to complete lack of production of silicomanganese, manganese metal, medium carbon ferromanganese in Russia, and the demand for carbon ferromanganese is only partially satisfied with the blast furnace ferromanganese produced at Kosogorsky and Alapaevsky steel works, both located in Russia.

Out of the total proved manganese ore reserves on the territory of the former USSR (more than 3 billion tonnes) 74.5% is concentrated in the Ukraine, 13% is in Kazakhstan, 7.5% is in Georgia and only 5% is located in Russia. At present Russia has not a single major operating plant for the production and benification of manganese ores, and the development of its own raw materials sector will require not less than 7 to 10 years and a large amount of investments. This means that for a long term Russia will remain a major buyer of manganese ferroalloys and manganese ore to produce carbon ferromanganese in blast furnaces.

Setting up of capacities for the production of medium carbon ferromanganese and manganese metal is a pressing matter due to existing limitations for purchasing them in Georgia and Ukraine.

Ferrochrome facilities in Russia operated at about 62% of their capacities in 1994. The increase of this share in coming years is unlikely because of the cuts in deliveries of chrome ore from the Donskoy mine and concentrator (Kazakhstan), which is the main supplier of the chrome raw material for the ferroalloy industry in CIS. Though the reserves of chrome ore in Russia are estimated at about 700 mln MT their further prospecting and commercial large-scale development, basically in Karelia (Aganorzersk) and in the Ural region (Rai-Izskoe), will be feasible probably after the year of 2000. The opportunities for the increased use of the ores from the Saranovsk deposit are limited. The shift is expected in the production share of ferrochrome from low carbon ferrochrome to high carbon grades. This is primarily explained by the expected demand at the Chelyabinsky steel works which has installed AOD capacities for the annual production of up to 380,000 stainless steel ingots. To obtain this goal reconstruction projects will be accomplishes at the Chelyabinsky Electrometallurgical works and the Serovsky ferroalloys plant.

Ferrosilicon capacities were operating at about 55% during 1994. Taking into account a comparatively favourable situation with the energy supply and raw materials availability, expansion of ferrosilicon output depends wholly on the market capacity. At present there is a trend to expand ferrosilicon output with higher silicon content (70-75% Si). For instance, if the production of ferrosilicon, containing 20-25% Si was more than 100,000 MT in 1990, there was actually no production of these grades in 1994. In this connection some of the furnaces, operating in the closed mode will be converted to the open mode with the post-combustion of gases in the top.

The production of ferroalloys belonging to so called low tonnage group (alloys of vanadium, titanium, boron, molibdenium, tungsten, niobium, chrome metal, silicocalcium, silicozirconium, ferrophosphorous, a number of alloying compositions and modificators) at the Russian plants takes into account the existing demand of the other CIS countries as well. The capacities for the production of the above alloys sufficiently surpass the domestic demand of the Russian economy, and the scope of their output depends in many cases on the availability of raw materials. Only the production of silicocalcium, ferrovanadium and ferroboron is based totally on domestic raw materials. Raw materials for other ferroalloys of this group are supplied in general from other republics of the former USSR. In 1994 the capacities for the production of low tonnage group went down to 2-40%. This may be generally attributed to a sharp fall in the production of special steels and alloys, where these ferroalloys found main use, as well as to non-competitiveness of a number of alloys because of high prices for the relative ore concentrates.

Russian ferroalloys producers experience no significant problems related to power supply except for its continuous price increase. Power prices went up 4-7 thousand times late in 1994 compared to 1990, and the price increase by 30-40% was again seen in January, 1994, which makes problematic cost efficient production of some ferroalloys. If this tendency keeps on in conditions of anti-dumping import duties, imposed in some parts of the world market, the export capability of the Russian producers will diminish. A general analysis of the situation shows that there will be no major changes in the volumes and structure of ferroalloys production in 1995 compared to 1994, though a 10-12% decline in outputs is probable.

UKRAINE

The ferroalloy industry in the Ukraine, which has a large export potential in respect to manganese and silicon alloys, was unable to compensate shrinking demand in the inner market by a larger volume of export outside CIS. To a great extent it is determined by a higher phosphorous content in ferroalloys (up to 0.6%), produced from the manganese ore of the Nikopol deposit. Operation of capacities was as a whole down to about 46% in 1994. In conditions of the total fall in output by 51% by 1990, silicomanganese production decreased by 42,5%, carbon ferromanganese dropped by 30% and ferrosilicon (45% silicon base) was down by 53%. At the same time production of medium carbon ferromanganese went up five-fold because of 72% fall in manganese metal output. The latter two items are produced at the Zaporozhye plant in its shop which previous production was basically limited to manganese metal. At present this ship is being refurbished to a state-of-the-art level and will have its furnace transformers upgraded from 5 to 7.5 MVA. Medium carbon ferromanganese is purchased quite well because its production at the Zestafonsky plant, that was once the major supplier of the ferroalloy, dropped sharply (by 93%).

At present the Ukraine is taking measures to set up small volume production of the low tonnage group to be produced by the thermometallic process (ferrotitanium, ferroniobium, ferrotungsten, ferromolybdenum).

An acute problem in perspective might spring up, caused by the decline in output of Nikopol basin's manganese concentrates due to deficiency of funds to maintain and develop mining operations, which may curb manganese supplies to Russia and other CIS countries. The matter is being discussed at the government level. Setting up of an inter-state joint-stock company would be a conceivable approach to develop production of manganese ore and concentrate at the mines and concentrators in the Nikopol manganese ore basin.

In general 1995 might evidence a further 10 to 15% decline in ferroalloys production, caused among other reasons by a shortage of energy resources in the Ukraine.

KAZAKHSTAN

The ferroalloy plants in Kazakhstan that were generally oriented to the market in Russia (ferrosilicon, ferrochrome, silicochrome), in the Ukraine (ferrochrome) and in other republics of the former USSR, feel acute undercapacity for ferroalloys production. The ferrosilicon production was dependant on the raw materials (quartzite, coke, iron additions) supplied from Russia. The production of the local quartzites started at Teksturmassky deposit only in 1994.

In this situation Kazakhstan closed down the production of non-competitive low carbon ferrochrome, manufactured at the Aktyubinsk plant which is expanding the output of carbon ferrochrome at present.

The Yermakovsky plant is planning to gradually switch ferrosilicon capacities, now idle, to the production of high carbon ferrochrome (exceeding 300,000 tpy) and manganese alloys, using Kazakhstan ore for this purpose. In 1994 their production (mainly silicomanganese) was about 37,000 mt.

Higher output of ferrochrome in Kazakhstan is creating already now a problem with chrome ore availability at the Russian plants. In addition the Donskoy mine and concentrator, the monopoly supplier of chrome ore in CIS, has been dropping volumes of production and requires major investments to maintain and develop its capacities.

The phosphorous plant in Jambul has among others a claim on the processing of local manganese and chrome ores, due to the availability of electric furnace capacities up to 600 MVA which became idle because the plant stopped yellow phosphorous production determined by a sharp decline in demand for mineral fertilisers. However higher output of manganese alloys in Kazakhstan is limited by the low availability of manganese ore and by obtaining major investments to expand the production at the Jaremsky Mine and Concentrator.

We may forecast a further decline in ferroalloys production in Kazakhstan, which may be down by about 15% in 1995.

GEORGIA

The ferroalloy and mining industries in Georgia face a difficult situation. The political instability, lack of electric power in Trans-Caucasia, upsets of former industrial relations caused idle intervals of 6 to 7 months in falls and winters during recent years at the Chiaturamarganets plant, supplier of the manganese ore, and its consumer, Zestafoni ferroalloys plant. The production of ferroalloys fell by 11 times in 1994 compared to that of 1990. To restore the ferroalloys production at this plant more stable operation of Chiaturamarganets is required, as well a power supply to Georgia from Russia in the range of 60-100 MW during fall and winter. This also should be supplemented by partial supplies of manganese ore from the Ukraine and high quality imported ore for the production of medium carbon ferromanganese, as the Zestafoni ferroalloys plant is the major supplier of this alloy to all the CIS countries. However it is most unlikely that these problems will be solved during coming years. As a result, ferroalloys output at the Zestafoni plant in 1995 will be at the level of 1994 or slightly higher than that.

ECOLOGICAL PROBLEMS

All the ferroalloys' producers consider as very pressing the problem of detrimental matters' discharge into the atmosphere, though most of the electric furnaces employ dust cleaning systems. All furnaces with roofs have a wet three stage gas cleaning system using the scrubber -Venturi - cyclone route. Most of the open-roof furnaces use dry fabric filters and partially electric filters. The total amount of detrimental matters discharged into the atmosphere by the main producers of ferroalloys was 258,000 tonnes in 1988, including 70,000 tonnes in Russia, 83,000 tonnes in the Ukraine, 90,000 tonnes in Kazakhstan and 15,000 tonnes in Georgia.

Government authorities imposed maximum allowable limits for dust and gaseous products discharge (carbon oxide, sulphurous anhydride, NOx). Chelyabinsky, Serovsky, Yermakovsky and Aktubinsky plants will have to comply to improved limits by 2000 and Zaporozhsky and Zestafonsky plants by as early as 1995. The other plants' discharges are practically within the established limits. All the plants incorporate closed water circuits and practically make no discharges of waste water into outside basins.