InfoMine research group

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Coal Pitch Market Research in the CIS

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ANNOTATION

The actual report is devoted to study of current situation in the market of Coal Tar Pitch in the CIS countries and to the forecast of its development. The Report consists of six Sections, contains 84 pages, including 38 tables, 30 figures and 2 supplements. This work is a desk research. As information sources we used the data of Federal State Statistics Service (Rosstat), the State Committee of Statistics for CIS countries, Federal customs service of the Russian Federation (RF FCS), the branch official statistics of railroad transportation of the Russian Federation, the branch and regional press, annual and quarterly accounts of emitters of securities as well as Internet sites of the enterprises manufacturers and consumers.

The Report's **First Chapter** presents features of raw materials brief required for pitch manufacturing. The Section also considers methods and peculiarities of pitch generation, its marks and characteristics.

The **Second Chapter** of the Report is devoted to production of the pitch in the CIS countries (Russia, Ukraine and Kazakhstan). This Chapter of the Report provides data in regard of this product volume of output in 1994-2009 at the CIS enterprises. In addition a section of the Chapter is devoted to description of the current status of the principal pitch producers in the CIS including in particular supply data.

The **Third Chapter** of the Report contains data over pitch foreign trade operations in Russia (1994-2009), in Ukraine (1999-2009), in Kazakhstan (1995-2009) and in Tajikistan (2003-2009).

The **Fourth Chapter** analyses movement of pitch export-import prices in Russia (1994-2009) and in Ukraine (1999-2009).

The **Fifth Chapter** of the report assesses pitch consumption in Russia. This Chapter provides balance between the pitch output and consumption (1994-2009), the branch structure of consumption, quotes Russian principal consumer (giving volumes of consumption in 2003-2009) as well as pictures current status and prospects for development of major consuming enterprises (aluminium and electrodes plants).

The Sixth, final chapter of the report provides forecast for the pitch production in Russia and in Ukraine as well as outlook for pitch consumption in Russia until 2015.

The Supplements provide contact information for pitch producers and consumers in the CIS countries.

Introduction

Target issue of this study is the market of coal tar pitch. It comprises big enough number of participating enterprises, which belong to various branches of industry (coal-mining, ferrous- and non-ferrous metallurgy).

As is known, processing of coking coal is carried out at coke plants, which belong to ferrous metallurgy. They obtain coking coal from coal-mining enterprises.

Coal tar being produced at coke plants is raw material for production of the pitch. Industrial pitch is the key component for manufacturing of anodic paste, graphitized electrodes, and various carbonic engineering materials, which are produced at enterprises of non-ferrous metallurgy (electrode and aluminium plants). Meanwhile, some portion of pitch is used in pitch coke production.

The scale of pitch production depends primarily on production of coal tar, and coal tar volume of output depends on the quantity of metallurgical coke consumed in pig-iron production.

Thus, output of coal tar, pitch and pitch coke decides the leading role of coke enterprises in supplying non-ferrous metallurgy enterprises with carbonic raw materials required for manufacturing of commercial commodity. However, the production of tar coal, pitch and pitch coke is a co-production process, and it depends on the volume of metallurgical coke output.

An analysis of trends in ferrous metallurgy concludes that blast-furnace process will secure its importance in spite of development of alternative technologies (e.g. direct reduction of iron) for quite a long. This, in its turn, will at least support demand for metallurgical coke, which could be just partially substituted with some other kind of fuels in the blast-furnace process.

On the other hand, there is some increase in consumption of pitch being observed because any reasonable substitute for pitch does not exist. High demand for pitch constrains production of pitch coke. Meanwhile the role of pitch coke is not so high for it is possible to use petroleum coke as its substitute. In any case, demand for steel making coke, pitch and pitch coke is most often very much different.

1. Raw Materials for Pitch and its Production Methods; Quality Specifications

1.1. Raw Materials for Pitch Fabrication

Tar pitch is raw material for pitch production. It is one of by-products of charge coal carbonization at by-product coke plants. Volatile matter produced by carbonization process quit the cells and enter gas collector for recovery. Coal tar is being produced at recovery shops of by-product coke plants.

Composition, yield and properties of coal tar depend on composition of the coal charge, oven design and carbonization conditions (first of all, on the temperature of under-roof space and holding time of the volatiles inside the oven).

Yield and quality of coal tar are determined by content of volatiles in the charge (the higher the volatiles content, the better will be pitch). That is why the content of G, GZhO, GZh brands (gas coals) should be as large as possible in the charge, though, from the point of view of metallurgical coke manufacturers, the former two brands represent low-coking and of-limited-use coal. Thus, the maximum yield of pitch does not always correspond to the output of high-quality metallurgical coke.

In 70-80s of the XX century, the development of by-product coking industry in the former USSR led to increase in the yield of tar and improvement of its quality. Predominantly that was due to increase in proportion of gas coal in the charge (especially at Ukrainian enterprises). Besides, large-capacity ovens were put into operation, and the coking temperature increased. At that, quality properties of coal tar also modified considerably. Its density rose, the content of insoluble with toluol and quinoline substances increased and yield of pitch grew. Improvement in tar quality came from a number of modern technical solutions for carbonization of the charge: reduction of under-roof space in coking box and minimization of dust fractions rate in coal charge.

However, in the middle of 90s, quality of coal tar produced at enterprises of the former USSR somewhat decreased. The reasons are failures in coking coal supply and inconsistent quality of coal charge being processed.

By-product coke producing capacities in the USSR were most advanced in Russian Federation and Ukraine. Major tar pitch producing enterprises in Russia boast its yields from metallurgic coke in the range of 4.2%-4.8%. Output of tar pitch in Russia in 2003-2008 accounted for some 1.2-1.3 million ton; in 2009 it decreased to 1.1 million ton. Tar output in Ukraine till recently stood for 900,000 ton; in 2009 it dropped down to 750,000 ton.

1.2. Pitch Production Technology

Coal tar for pitch making is being processed at tar-processing shops. There are 17 tar-processing shops in the CIS territory.

In CIS countries, tar-processing shops operate practically under the same workflow as follows: rectification of tar through one-pass vaporization in a continuous flow tubular unit equipped with one or two rectification towers. Capacity of tar-processing shop at most big enterprises stands for 200 thousand ton of tar per annum.

Coal pitch is the most large-tonnage product of coal tar processing and its yield from tar accounts for up to 60%.

Key properties of pitch obtained through tar distillation are density, viscosity, surface tension, wettability, thermal stability, sintering ability as well as ability of producing carbon residue. These properties are not the same for pitches with different softening temperature, and depend on the raw material quality and conditions for pitch manufacture. Properties of medium-temperature pitch (softening temperature below 100 degree) are generated by features of tar and conditions of its distillation.

Major pitch quality stabilizing factor is invariability of tar properties set. This feature, in its turn, depends on stability of coal charge processed at by-product coke plants.

It should be noted that the main mission of by-product coke plants is obtaining metallurgical coke and all technological factors of coking furnaces operation serve that mission. That is why, in most cases no attention is paid to the matters of regulating the pyrolyzation degree of the tar at the coking stage (the degree should be either low or medium), which affects quality of electrode pitch production.

Table 1 shows the characteristics of medium-temperature electrode pitch produced at some CIS enterprises.

Table 1: Characteristics of Pitch Produced in the CIS

Supplier	Electrode pitch as binder (GOST 10200-83)			
	Softening temperature, C°	Yield of Volatiles, %	Fraction content, %	
			α	α_1
Brand B	*67-73*	*58-62*	*25-31*	-
"ChMK"	70.5	59.2	33.9	13.5
"NTMK"	67.0	59.5	32.0	7.0
"MMK"	73.0	59.2	24.5	8.3
"ZSMK"	75.0	55.0	41.0	12.0
"Dneprodzerzhinsk Chemical Coke Plant"	67.7	60.8	30.2	3.5
"Zaporozhe Coke"	68.0	56.7	36.5	8.4
Brand V	*85-90*	*53-57*	*< 31*	*< 12*
"ZSMK"	88.0	54.0	50.0	17.0
"Makeyevka Chemical Coke Plant"	87.0	55.4	43.2	8.2
"Gubakhino Chemical Coke Plant"	90.0	52.0	44.0	12.0

Source: analysis of articles published in the "Coke and Chemistry" journal

In the process of manufacture of high-temperature pitch (softening temperature over 100 degrees), medium-temperature pitch is subjected to thermal treatment in still-reactors (the number of them at operating mounts varies from five to eight units). Russian by-product coke industry operates bubbling still-reactors of vertical tar-still design. The yield of high-temperature pitch nears 85-87%. According to the experts, the method of thermal treatment in still-reactors provides rather limited capabilities for regulation of physical-and-chemical properties of high-temperature pitch produced, which properties are much more dependent on characteristics of original tar than on process variables.

Table 2 shows the characteristics of high-temperature pitch produced at some CIS enterprises.

Table 2: Characteristics of High-Temperature Pitch Produced in CIS

Enterprise	Softening temperature, C°	Fraction content, %		Yield of Volatiles, %	Carbon residue, %
		α1	α 2		
"Zaporozhe Coke"	140	29.6	17.2	50.5	64.2
"Sever Steel"	142	30.3	18.4	48.8	66.3
"Mittal Steel Temirtau"	140	30.5	14.0	54.6	60.8

Source: analysis of articles published in the "Coke and Chemistry" journal

High-temperature pitch is produced in large quantities at by-product coke plants in the CIS, but it is just an intermediate product for pitch coke production. Until recently, pitch as a commodity product was produced at Gorlovsk by-product coke plant (at present - OJSC “Tar Processing Plant”, Ukraine), now *its* production has been launched at some other enterprises (in particular, OJSC “Sever Steel”).

High-temperature pitch is produced at “Gorlovka Chemical Coke Plant” at a 33,500 tpa unit operating the method of continuous oxidation in three still-reactors with the total capacity of 150 m^3. Granulation and filling-up of pitch is carried out at a granulation unit. Softening temperature for the high-temperature pitch produced is 155-160 degree, content of ashes is 0.07-0.19%; humidity is 1.4-2.0%.

1.3 Quality Specifications for Pitch Produced in the CIS

As was mentioned above, coal pitch is a unique binder component for manufacture of anodic paste, graphitized electrodes, engineering and other materials. Most of electrode pitch is used for these purposes.

Quality Specifications for coal electrode pitch in the USSR were regulated by the GOST 10200-83 standard. Under these standards, pitch coke is produced in three brands (A, B, V).

Medium-temperature generated from high-pyrolization tar in the process of its continuous distillation is also used as binder for anodic paste production. Properties of this pitch are regulated by the TU 14-7-83-86 requirements.

Properties of pitch for other purposes (besides electrode pitch) are set by the GOST 1038-75 regime. The standard supposes obtaining medium-temperature A and B brands pitch, as well as high-temperature pitch for pitch coke production.

Major requirements to pitch for pitch coke production are softening temperature and ashes content. The higher softening temperature and the lower ashes content, the better raw material for coking the pitch is considered to be. Therefore, according to expert, the requirements to ashes content, regulated by GOST 1038-75 (less 0.2%) are lower against most values of foreign brands (excluding Japan).

Brands A and B medium-temperature pitch can be used for production of structural materials, tape paste for blast furnaces and for some other purposes.

Besides medium-temperature pitch, high-temperature (high-melting) pitch is used as a binder at production of carbon electrical materials and carbonic engineering materials. It should match requirements of TU 14-6-84-72.

In electrode production, penetrating-type coal pitch is used for soaking graphitized electrodes matching requirements of TU 14-7-70-80.

Regulated also are Specifications of high-temperature pitch, which is used in blast-furnace refractory mixtures (TU 14-6-128-75) and in manufacture of anodic paste (TU 14-6-65-85).

Thereby, specifications of several brands of high-temperature pitch being used in manufacture of various kinds of products are regulated by the standards: pitch coke as binder for anodic paste, engineering and graphitized carbon items and blast-furnace refractory mixtures (see table 6).

The most promising field of high-temperature pitch application is fabrication of pre-burnt anodic blocks which allows improvement of technological effectiveness of aluminium production and environment protection.

Vide variety of spheres for high-temperature pitch applications also determine this product's different quality specifications, which cannot reflect the existing standards for engineering specifications in total. For example, anodic paste manufacture requires pitch to add high mechanical strength to a burnt block (with concurrent bearing minimum of harmful substances in volatile products of carbonization). Engineering materials fabrication requires pitch, which forms easy-graphitized coke with minimal specific resistance, and carbon electrical materials manufacture requires pitch with enhanced plasticizer properties; production of refractory mixtures for blast furnaces needs pitch with high fusing and increased coke-formation properties.

Table 3: Pitch Quality Specifications

Index	Electrode pitch* GOST 10200-83			Medium-temperature pitch TU 14-7-83-86	Coal pitch GOST 1038-75			High-temperature pitch TU 14-6-84-72		Penetrating-type coal pitch TU 14-7-70-80	High-temperature pitch		
	A	B	V		A	B	high-temperature	V	G		TU 14-6-128-75		TU 14-6-65-85
											A	B	
Softening temperature, C^0	65-70	67-73	85-90	65-72	67-75	76-83	135-150	120-135	135-195	70-75	221-250	200-220	110-120
Mass concentration, %													
Toluol insoluble substances	24-28	25-31	25-31	25-31	No standard		-	43-48	46-54	19	-	-	39-45
Quinoline insoluble substances	7	8	12	11	No standard		-	18-20	20-32	5	-	-	20
Yield, %													
Volatiles	59-63	58-62	53-57	55-60	No standard		<51	No standard		<64	-	-	47-53
Coke, less	No standard							57-59	54-60	-	65	60	56
Ashes, less	0.3	0.3	0.3	0.2	0.4	0.4	0.2	0.2	0.2	<0,3	0,3	0,3	0,3
Field of application	Binder for anodic paste, graphitized electrodes and engineering materials production			Binder for anodic paste production	Structural materials and bottling clay production		Pitch coke production	Engineering graphitized carbon material production		Soaking graphitized electrodes	Refractory mixtures for blast furnaces		Anodic paste

**Temperature characteristics of pitch: Temperature C°: flash, over 210, inflammation, over 250, spontaneous ignition, over 570, field of vapor inflammation 125-145*