Coal Tar Pitch in the CIS: Production, Market and Forecast

9th Edition

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Annotation

This report is the 9th edition of research of the market of coal tar pitch in the CIS countries.

The purpose of research is an analysis of the market of coal tar pitch.

The object of the study is coal tar pitch, and the report also deals with the market of coke, graphite electrodes and aluminum.

This work is a desk study. As information sources, we used data of Federal Service of State Statistics of Russia (Rosstat), the Statistics Agency of the Republic of Kazakhstan, the State Statistics Committee of Ukraine, the statistics of the Russian rail transportation, and of the Federal Customs Service of Russia, the UN database (UNdata), and the proprietary database of InfoMine. In addition, data of the sectoral and regional press, annual and quarterly reports of companies - issuers of securities, internet-sites of company-producers of coal tar pitch were employed.

Chronological scope of the study: 1994-2016; the first half of 2017, the forecast – up to 2025.

Geography of research: the CIS (Russia, Ukraine, Kazakhstan, and Tajikistan).

The volume of the study: the report consists of 6 Sections, contains 117 pages, including 38 Tables, 32 Figures and 2 Appendices.

The first chapter of the report presents data on resources, required for production of coal tar pitch. In addition, this chapter considers the methods and features of obtaining pitch, its brands and characteristics.

The second chapter is devoted to the production of coal tar pitch in the CIS countries (Russia, Ukraine, and Kazakhstan). This section of the report presents data on release of these products in 1994-2016 at the enterprises of the CIS. In addition, part of the chapter is devoted to describing the current state of the main producers of the pitch in the CIS, in particular, data on their shipments.

The third chapter of the report presents data on foreign trade operations in coal tar pitch in Russia (1994-2016, the 1st half of 2017), Ukraine (1999-2016, the 1st half of 2017), Kazakhstan (1995-2016, the 1st half of 2017), and Tajikistan (2003-2016).

The fourth chapter analyzes data on dynamics of export-import prices on the pitch in Russia (1994-2016, the 1st half of 2017), Ukraine (2001-2016, the 1st half of 2017), and in Kazakhstan (1995-2016, the 1st half of 2017). Some domestic prices on pitch of the Russian manufacturers are presented.

The fifth chapter of the report analyzes the consumption of coal tar pitch in Russia. This section presents the supply-demand balance of pitch (1994-2016), the sectoral structure of consumption, the main Russian consumers (together with volumes of consumption in 2003-2016). This chapter also describes the current standing of the largest enterprises-consumers (the aluminum and electrode plants).

The sixth, final chapter of the report presents the forecast of production of coal tar pitch in Russia and Ukraine, as well as a forecast of consumption of pitch in Russia for the period up to 2025.
The Appendices contain contact information on producers and consumers of coal tar pitch in the CIS.

**The target audience of the research:**
- Participants of the market of the coke-chemical, aluminum and electrode products - manufacturers, consumers, traders;
- Potential investors.

The presented research claims to be the reference tool for marketing services and for professionals, making managerial decisions in the market of the coke-chemical, aluminum and electrode products.
Introduction

The object of this study is the market of coal tar pitch. It includes a fairly large number of participating enterprises belonging to different industries (the coal industry, the iron and steel industry, and the industry of non-ferrous metals).

As it is known, the processing of coking coal is carried out by coke enterprises, which belong to the steel industry. These plants receive coking coal from enterprises of the coal industry.

Coal tar, released at coke plants, is a raw material for the production of pitch. Commodity pitch is an essential component for the production of the anode paste, graphite electrodes, and various carbon structural materials released by enterprises of the non-ferrous metallurgy (electrode and aluminum plants). At this, part of the pitch is directed for the production of pitch coke.

Volumes of the pitch production are determined primarily by the release of coal tar, and, in turn, its volume depends on the amount of metallurgical coke consumed in the production of pig iron.

Thus, the release of coal tar, pitch and pitch coke determines the leading role of coke-chemical enterprises in providing the non-ferrous metallurgy with carbonaceous raw materials, which are necessary to manufacture commodity products. However, the production of coal tar, pitch and pitch coke is a by-process, and it depends on the release of metallurgical coke.

The analysis of trends in development of the steel industry of the CIS countries implies that the blast furnace process, in spite of the development of alternative technologies (for example, the method of direct reduction of iron), will retain its value for a sufficiently long-term perspective. This in turn will promote a demand for metallurgical coke, which only partly can be replaced by other types of fuels in the blast furnace process.

On the other hand, an increase in consumption of pitch is observed, particularly given the fact that there are yet no other viable alternatives to pitch. The need to meet the requirements in pitch limits the production of pitch coke. In turn, pitch coke has a lower value, as it can be replaced by petroleum coke. In any case, the demand for metallurgical coke, pitch coke and pitch is most often differently directed.
1. Raw materials for production of pitch, methods of its preparation, quality requirements

1.1. Raw materials for production of pitch

The raw material for releasing coal tar pitch is coal tar, one of the products of coking the coal charge at coke-chemical plants. Volatile products, formed during the coking of coal come out of the coking chambers and enter the gas collector. Coal tar is available in the workshops of collecting of coke-chemical enterprises.

The composition, yield and properties of coal tar depend on the composition of the coal charge, the design of furnaces and coking conditions (primarily on the temperature of the underroof space and a residence time of volatiles in the furnace).

The yield and quality of coal tar are determined by the content of volatiles in the charge (the higher the content of these components, the better will be pitch). Therefore, the content of volatiles in the charges of the grades G, GZhO, GZh ("gas" coals) should be the highest possible, though, from the point of view of producing metallurgical coke, the first two brands are low-coking coals of limited usability. Therefore, the need to maximize the output of pitch does not always correspond to the release of the high-quality metallurgical coke.

In the 70-80’s of the XX century in the former USSR the development of the coke production has led to the increase in the yield of coal tar and the improvement of its quality. This is largely due to the increased share of the "gas" coal in the charge (especially for the Ukrainian companies). In addition, heavy-load furnaces were introduced and the temperature of coking was increased. Qualitative characteristics of coal tar have also significantly changed. Its density increased, the content of substances insoluble in toluene and quinoline became larger, and the yield of pitch increased. The improvement of the quality of tar was also due to a number of technical solutions for coking the charge: the decrease of the volume of the underroof space in the coking chamber and a reduction of dust fractions in the coal charge.

However, in the mid-90’s the quality of coal tar, released in the enterprises of the former USSR, somewhat deteriorated. This was due to disruptions of supply of coking coal and an unstable quality of the processed coal charge.

In the former USSR, the coke-chemical facilities have been particularly well developed in Russia and Ukraine. The output of coal tar in the main companies-producers in Russia amounted to 4.2-4.8% of the release of metallurgical coke. The volume of the coal tar production in Russia in 2003-2008 stood at about 1.1 million tons, in 2009-2010, production was reduced to XXX thousand tons, and in 2011 it reached the level of about 1 million tons. In the following years (2013-2014) again there was a decline in production to XXX thousand tons. This level (with the exception of 2015) is preserved to this day.

The release of coal tar in Ukraine until recently was approximately 900 thousand tons, in 2009 it dropped to 750 thousand tons. Later the coal tar production was at the level of XXX thousand tons, and in 2015-2016 a sharp decline was recorded - to XXX thousand tons.
1.2. Technology for producing pitch

For producing pitch, the coal tar is processed in tar-processing shops; in the CIS there are XXX such shops.

All tar-processing shops at the CIS enterprises operate on virtually the same scheme, which provides a fractionation of a tar at its flash evaporation in a continuous tubular unit equipped with one or two rectification columns. In most large enterprises the capacity of tar-processing shops is 200 thousand tons of tar per year.

Coal tar pitch is the large-tonnage product of processing coal tar; its yield is up to 60% of tar.

The most important properties of pitch, obtained by distillation of tar, are the density, viscosity, surface tension, wettability, thermal stability, sinterability, and the ability to give coke residue. These properties are different for pitches with various softening temperatures, and depend on the quality of raw materials and the conditions for obtaining pitch. The properties of the medium-temperature pitch (the softening temperature is not more than 100 degrees) are mainly influenced by the properties of the tar and the conditions of its distillation.

The main factor contributing to the stabilization of the quality of the pitch is the constancy of the properties of the tar. This, in turn, is determined by the stability of the coal charge, which is processed by coke-chemical enterprises.

It should be noted that the main objective of the coke-chemical plants is to obtain metallurgical coke, and all the technological factors of operation of coke ovens are subordinated to this task. Therefore, in most cases, not much attention is given to regulation of the degree of pyrolization of tar at the carbonization stage (it should be low or moderate), which adversely affects the quality of the resulting electrode pitch.

Characteristics of the medium-temperature electrode pitches of some enterprises of the CIS are presented in Table 1.
Table 1: Characteristics of medium-temperature pitch, produced in the CIS

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Electrode pitch as a binder (GOST 10200-83)</th>
<th>Amount of fractions, %</th>
<th>( \alpha )</th>
<th>( \alpha_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brand B</strong></td>
<td>Softening temperature, °C</td>
<td>Yield of volatiles, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant 1</td>
<td>67-73</td>
<td>58-62</td>
<td>25-31</td>
<td>-</td>
</tr>
<tr>
<td>Plant 2</td>
<td>70.5</td>
<td>59.2</td>
<td>33.9</td>
<td>13.5</td>
</tr>
<tr>
<td>Plant 3</td>
<td>67.0</td>
<td>59.5</td>
<td>32.0</td>
<td>7.0</td>
</tr>
<tr>
<td>Plant 4</td>
<td>73.0</td>
<td>59.2</td>
<td>24.5</td>
<td>8.3</td>
</tr>
<tr>
<td>Plant 5</td>
<td>75.0</td>
<td>55.0</td>
<td>41.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Plant 6</td>
<td>67.7</td>
<td>60.8</td>
<td>30.2</td>
<td>3.5</td>
</tr>
<tr>
<td>Plant 7</td>
<td>68.0</td>
<td>56.7</td>
<td>36.5</td>
<td>8.4</td>
</tr>
<tr>
<td><strong>Brand C</strong></td>
<td>Softening temperature, °C</td>
<td>Yield of volatiles, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant 7</td>
<td>85-90</td>
<td>53-57</td>
<td>&lt;31</td>
<td>&lt;12</td>
</tr>
<tr>
<td>Plant 8</td>
<td>88.0</td>
<td>54.0</td>
<td>50.0</td>
<td>17.0</td>
</tr>
<tr>
<td>Plant 9</td>
<td>87.0</td>
<td>55.4</td>
<td>43.2</td>
<td>8.2</td>
</tr>
<tr>
<td>Plant 10</td>
<td>90.0</td>
<td>52.0</td>
<td>44.0</td>
<td>12.0</td>
</tr>
</tbody>
</table>

**Source:** review of scientific and technical literature (magazine Coke and Chemistry)

In order to obtain the high-temperature pitch (the softening point is above 100 degrees), the middle-temperature pitch is subjected to a heat treatment in cubes-reactors (their number on existing installations is between 5 and 8 units). The domestic coke industry uses cubes-reactors of the barbotage type, having a design of a vertical tar-distillation cube. This ensures the 85-87% yield of the high-temperature pitch. Experts believe that the method of the heat treatment in the cubes-reactors has very limited possibilities of regulating the physical and chemical properties of the resultant high-temperature pitch, which depend more on the characteristics of the starting tar than on the process variables.

Characteristics of high-temperature pitches of some enterprises of the CIS are presented in Table 2.

Table 2: Characteristics of high-temperature pitch, produced in the CIS

<table>
<thead>
<tr>
<th>Enterprise</th>
<th>Softening temperature, °C</th>
<th>Amount of fractions, %</th>
<th>Yield of volatiles, %</th>
<th>Coke residue, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \alpha_1 )</td>
<td>( \alpha_2 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant 1</td>
<td>140</td>
<td>29.6</td>
<td>17.2</td>
<td>50.5</td>
</tr>
<tr>
<td>Plant 2</td>
<td>142</td>
<td>30.3</td>
<td>18.4</td>
<td>48.8</td>
</tr>
<tr>
<td>Plant 3</td>
<td>140</td>
<td>30.5</td>
<td>14.0</td>
<td>54.6</td>
</tr>
</tbody>
</table>

**Source:** review of scientific and technical literature (magazine Coke and Chemistry)
High-temperature pitch is obtained in large quantities at coke-chemical plants of the CIS, but only as an intermediate in the manufacture of pitch coke. Until recently, as a commercial product it was manufactured at Gorlovka Coke Plant (now it is a part of OOO Tar Alliance, Ukraine), currently its release is mastered at a number of other companies (in particular, at OAO Severstal).

The high-temperature pitch at Gorlovka Coke Plant is released at the unit of the capacity of 33.5 thousand tons per year by the method of continuous oxidation in 3 cubes-reactors totaling 150 $m^3$. A granulation and pouring-in of pitch is carried out on the granulating machine. The softening temperature of the resulting high-temperature pitch is 155-160 degrees, its ash content - 0.07-0.19%, humidity - 1.4-2.0%.

### 1.3. Requirements to the quality of pitch produced in the CIS

As noted above, the coal-tar pitch is the only kind of a binder for production of the anode paste, graphite electrodes, structural and other materials. For this purpose, mainly the electrode pitch is used.

Quality requirements for the coal electrode pitch in the former USSR were regulated by GOST 10200-83. In accordance with these requirements, the electrode pitch is available in 3 grades (A, B, C).

As a binder in the production of the anode paste, also the medium-temperature pitch, obtained from tar of the higher pyrolysis during its continuous distillation, is used. The quality of this pitch is regulated by the requirements of TU 14-7-83-86.

The quality of pitches for other purposes (except the electrode pitch) is regulated by GOST 1038-75. It concerns the production of the medium-temperature pitch of grades A and B, as well as a high-temperature pitch for obtaining pitch coke.

The main requirements to pitch, used to manufacture the pitch coke, are the softening temperature and the ash content. The higher the softening point and lower the ash content, the better the raw material for coking. At the same time, according to experts, requirements for ash regulated by GOST 1038-75 (no more than 0.2%), are lower than most of the indicators of foreign brands (excluding those in Japan).

The medium-temperature coal tar pitch of grades A and B can be used for the production of building materials, a tap hole clay for blast furnaces and other purposes.

Together with the medium-temperature pitch in the manufacture of electric carbon products and carbon structural materials a high-temperature (high melting) pitch is also used as a binder. It must comply with TU 14-6-84-72.

The electrode production uses for impregnating graphite electrodes the coal tar pitch conforming to TU 14-7-70-80.

There are also regulatory requirements for the high-temperature pitch, used in refractory masses of blast furnaces (TU 14-6-128-75) and for the production of the anode paste (TU 14-6-65-85).

Thus, there are regulations for several brands of the high-temperature pitch, used in the manufacture of various types of products: for the release of pitch coke, as a binder in the release of the anode paste, structural and carbon and graphite products, and refractory masses of blast furnaces (Table 3).
The most promising application of the high-temperature pitch is for the manufacture of pre-baked anode blocks, the operation of which improves the manufacturability of the aluminum production process and an environmental situation.

The variety of applications of the high-temperature pitch determines the differing requirements for its quality, which only partially reflect existing standards and specifications. Thus, the production of the anode paste requires the pitch, which imparts the increased mechanical strength to the fired block (simultaneously with a minimum content of harmful substances in volatile products from carbonization). The release of structural materials requires pitch, forming a well-graphitizable coke with a minimum resistivity; the manufacture of electric carbon products – the pitch, having increased plasticizing properties; the production of blast furnace refractory masses – the pitch having good sintering properties and an increased coke-forming ability.
## Requirements to the quality of pitches

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Electrode pitch (^{a}) GOST 10200-83</th>
<th>Medium-temperature pitch GOST 1038-75</th>
<th>Coal tar pitch GOST 1038-75</th>
<th>High-temperature pitch TU 14-6-84-72</th>
<th>Coal tar impregnating pitch TU 14-7-70-80</th>
<th>High-temperature pitch TU 14-6-128-75</th>
<th>TU 14-6-65-85</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>of substances insoluble in toluene</td>
<td>7</td>
<td>8</td>
<td>12</td>
<td>11</td>
<td>Not rated</td>
<td>18-20</td>
<td>20-32</td>
</tr>
<tr>
<td>of substances insoluble in quinoline</td>
<td>59-63</td>
<td>58-62</td>
<td>53-57</td>
<td>55-60</td>
<td>Not rated</td>
<td>&lt;51</td>
<td>Not rated</td>
</tr>
<tr>
<td>Yield, %:</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.4</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Application</td>
<td>A binder for production of the anode paste, grafitized electrodes, construction materials</td>
<td>A binder for production of the anode paste</td>
<td>Production of building materials, pothole mass</td>
<td>Production of pitch coke</td>
<td>Manufacture of structural carbon materials</td>
<td>Impregnation of graphite electrodes</td>
<td>For refractory masses of blast furnaces</td>
</tr>
</tbody>
</table>

* - Temperature characteristics of pitch: a temperature, °C: of flash - not less than 210; of ignition - not less than 250; of auto-ignition - no lower than 570; the temperature of the vapor ignition - 125-145

Source: Rosstandartinform
2. Production of pitch in the CIS (1997-2016)

2.1. Dynamics of production and manufacturers of pitch in the CIS (Russia, Ukraine, Kazakhstan) in 1997-2016

In the CIS pitch is produced at enterprises of Russia, Ukraine and Kazakhstan. Production of pitch in the CIS in 1997-2002 was in the range of XXX million tons (Fig. 1). For the pitch production in the CIS since 2004 there is a tendency to stabilize its release at XXX thousand tons. A maximum output was recorded in 2004 - XXX thousand tons.

The reduced demand for pitch, caused by the economic crisis, led to a sharp drop in production in 2009 - to XXX’ thousand tons. In 2010-2011, there has been a growing trend, but in subsequent years, once again a decline was registered. In 2015, the production amounted to XXX thousand tons, and this index was minimal over the entire period under review. In general, the trend of the pitch production in the CIS in 1997-2016 has a tendency to decreasing.

Figure 1: Dynamics of the pitch production in the CIS in 1997-2016, thousand tons

Source: Infomine based on the data of Rosstat, the State Statistics Committee of Ukraine, and data of enterprises, an expert’s estimate

The ratio of production of pitch coke by enterprises of Russia and Ukraine varied for the period under review. In the early 2000s, the share of Ukraine accounted for 30-33% of the total output of pitch in the CIS, in 2009-2011 it rose to the level of 43-44%. In 2014 and 2016, due to a sharp decline in output, the share of Ukraine declined again (Fig. 2).