

Объединение независимых экспертов в области минеральных ресурсов,
металлургии и химической промышленности



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Feldspar in the CIS: Production, Market and Forecast

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Annotation

The present report is **the twelfth edition** of a study of the market of feldspar in the CIS countries.

Monitoring of the market is conducted **since 2002**.

Research objective is the analysis of the market of feldspar – of the world, Russian and the CIS countries market.

Objects of a research are feldspar raw materials and the feldspar and quartz-feldspar concentrates.

This work is **a desk research**. As **sources of information** we used data of Rosstat, Federal Customs Service of the Russian Federation, statistics of rail transportation of the Russian Federation, the Statistics Agency of the Republic of Kazakhstan, State Statistics Committee of Ukraine; materials of the United States Geological Survey (USGS), data of the base UNdata, the industrial and regional press, annual and quarterly reports of issuers of securities and also the websites of producers of feldspar products.

Chronological framework of a research: 2000-2019; the forecast - 2020-2025.

Research geography: the Russian Federation, Ukraine - the comprehensive detailed analysis of the market; Kazakhstan, Belarus, Uzbekistan, Kyrgyzstan - the general retrospective analysis of the market; the rest of the world - general information about dynamics and characteristics of the market.

The report consists of 8 chapters, contains 173 pages, including 39 Figures, 61 Tables and 1 Appendix.

Chapter 1 of the report presents a short characteristic of the world market of feldspar (reserves, extraction, production, the manufacturing countries, prices).

Chapter 2 of the report gives data on feldspar mineral resources in the CIS countries, the structure of reserves and characteristic of the main deposits.

Chapter 3 describes production technologies of feldspar products and requirements imposed to their quality.

Chapter 4 of the report is devoted to the extraction and release of feldspar products in the CIS countries. The chapter describes the current state of the main enterprises releasing feldspar in Russia; quantitative and qualitative characteristics of products are given for each enterprise; data on volumes and the directions of deliveries in the period of 2006-2019 are analyzed. Also, data are provided for some enterprises of feldspar products in Ukraine, Kazakhstan and Uzbekistan.

Chapter 5 reports data on the foreign trade operations with feldspar products in the Russian Federation and in Ukraine and also in Belarus, Kazakhstan and Kyrgyzstan (during 2000-2019). The statistical data are given on volumes of the foreign trade operations in natural and monetary terms, the regional structure of export and import of feldspar; on volumes and the directions of deliveries by the main exporters and importers.

Chapter 6 of the report provides data on dynamics of the export-import prices of feldspar in Russia and in Ukraine in 2000-2019 and the relevant prices on the domestic market of Russia.

Chapter 7 considers the consumption of feldspar in Russia in 2000-2019. The balance of production and consumption of these products is given in this section; the industry and regional structures of consumption are evaluated, as well as the main consumers and also current state and the prospects of development of the largest consuming enterprises. Also, this chapter gives the balance of production and consumption of feldspar products in Ukraine.

Chapter 8 of the report provides the forecast of development of the Russian market of feldspar until 2025.

The Appendix gives the address and contact information of the main enterprises releasing feldspar products in the CIS countries.

Target audience of research:

- participants of the market of feldspar products - producers, consumers, traders;
- potential investors.

The offered research can serve as a **handbook** for the marketing services and for specialists making administrative decisions on the market of feldspar products.

Introduction

Feldspars unite a large group of extremely widespread minerals, which by their chemical composition are aluminosilicates of potassium, sodium, calcium and barium. These are the major rock-forming minerals, over 50% of the mass of the Earth crust fall to their share.

All feldspars have rather low indices of refraction, great hardness (6.0-6.5), a perfect cleavage in two directions, which are crossed at an angle of about 90°, and a small density (2.5-2.7 g/cm³).

By the chemical composition feldspars are subdivided into three subgroups: sodium-calcium, potassium-sodium and potassium-barium feldspars.

Sodium-calcium feldspars are called plagioclases, they represent an isomorphous series of minerals with the variable content of sodium and calcium. Depending on the percentage of a calcic plagioclase - the anorthite (An) - the following kinds of plagioclases are allocated: albite NaAlSi₃O₈ (the content of An makes 0-10%), oligoclase (10-30), andesine (30-50), labradorite (50-70), bytownite (70-90), and anorthite CaAl₂Si₂O₈ (90-100). In this series the amount of silicic acid gradually decreases, and by its content plagioclases are subdivided into acidic (0-30% of An), intermediate (30-60) and basic (60-100). The temperature of melting of plagioclases fluctuates within 1100-1500 °C.

The basic plagioclases are widespread in gabbro, anorthosite, basalts and other basic rocks poor in silicon dioxide. Intermediate and acidic plagioclases are present in diorites, granodiorites, granites, liparites and other acidic rocks. Plagioclases are also found in nepheline syenites.

Potassium-sodium feldspars by crystallographic features are subdivided into monoclinic and triclinic; by the ordering of the structure - on low (low-temperature - with an ordered structure) and high (high-temperature - with a disordered structure). The most widespread are orthoclase KAlSi₃O₈ (monoclinic and low-temperature) and microcline KAlSi₃O₈ (triclinic and lowest-temperature). In addition, sanidine (monoclinic and high-temperature) is not uncommon.

In this subgroup pure potassium feldspars contain (in %): K₂O – 16.9; Al₂O₃ – 18.4; SiO₂ – 64.7. Practically in all potassium feldspars there is an insignificant amount of Na₂O – the isomorphous impurity of sodium-feldspar particles or ingrowths of a plagioclase.

The microcline and orthoclase are the main minerals in granitoids, granite pegmatites, nepheline and alkaline syenites. A less widespread sanidine is found in trachytes and liparites.

Potassium-barium feldspars are much less common than feldspars of other subgroups. They include hyalophane (K, Na, Ba)AlSi₃O₈ and celsian BaAlSi₃O₈. By the form of crystals and appearance they are similar to an orthoclase. Hyalophane contains about 16% of BaO.

The industry widely uses potassium-sodium feldspars. Among them the most important are microcline and microcline-perthite (microcline with ingrowths of plagioclase). In Russia their main source is ceramic and, partially, muscovite pegmatites. Feldspars form in pegmatites coarse-crystalline precipitates in the form of large blocks. Regular intergrowths of feldspars and quartz are often observed with the formation of a specific "graphic" structure characteristic only of pegmatites.

The main fields of use of feldspars are the ceramic and glass industries in which they are used as important input products of ceramic masses, furnace charges of glasses, glazes and enamels.

The use of feldspars in the ceramic industry is based on their ability to melt at rather low temperatures with the formation of a vitreous matrix.

In the glass industry feldspars are used to add aluminum oxide into the composition of the furnace charge, as the presence of aluminum oxide improves chemical and mechanical properties of the glass.

1. The world market of feldspar

Extraction of feldspar is carried out in more than 50 countries of the world.

The world reserves and resources of feldspar raw materials are not estimated. They are very seldom given in the world statistics and reviews on separate objects of this or that country. However, because feldspars are one of the most widespread minerals of the earth crust, the identified and projected resources are sufficient for satisfaction of the global demand for these raw materials.

The main source of feldspars are pegmatites. Besides fields of pegmatites, feldspar raw materials in the world are extracted also at working off of fields of alaskite granites (Sirusa-Pine in the USA), aplites (Kamaya in Japan, Payni in the USA, Meldon in England); and in addition the muscovite and rare metal granites in the USA, Germany, France are involved in operation. The largest source of raw materials for the glass industry are nepheline and alkaline syenites of Blue Mountain fields in Canada (developed by the Unimin company) and Stjernoya in Norway (developed by the North Cape Minerals company).

In Italy fields of micaceous slates and sands with receiving products of mainly sodium composition are developed for production of ceramic tile. In France, deposits of phonolites and other volcanic rocks are exploited, in Germany - pegmatites, kaolinized granitoids, phonolites, in Mexico - crystalline tuffs. In the USA, the processing of pegmatites, including the rare metal and muscovite pegmatites, as well as sands, gives products of any composition (from high potassium to sodium), with a significant proportion of it being flotation concentrates for the ceramic and glass industries. In Finland, the main source of feldspar raw materials is the pegmatite veins on the island of Kemiya.

According to United States Geological Survey, the world production of feldspar in 2000-2008 constantly increased, for this period the growth was 230%, in 2008 the outputs reached 21.9 million tons. In 2009-2010, this indicator decreased somewhat and made about 20 million tons. Since 2011, a new increase in production began, but the growth happens at slow rates. In 2016, according to United States Geological Survey, in the world about 23.6 million tons of feldspar were produced, in 2018-2019 - 25.5-26 million tons (Table 1).

Leaders in production of feldspar are three countries - Italy, Turkey and China, each of them produces more than 3 million tons of feldspar annually. 55-60% of the world extraction of feldspar fall to the share of these three countries.

The largest producer of feldspar products in the world is Turkey. In 2008, production of feldspar in the country amounted to 6.5 million tons (by 1.7 times more than in 2007) that brought Turkey to the leading position among global manufacturers. However, in 2009-2010 the outputs reduced to 4.2-4.5 million tons. In 2011-2016, the Turkish enterprises produced 5-5.5 million tons of feldspar a year. In the next years, the new growth of production followed - in 2018-2019 production of feldspar products reached 7.5 million tons.

Italy is in the second place on production of feldspar products. Annually in the country 3.5-4 million tons of feldspar are extracted.

The third place on volumes of extraction of feldspar in the world is taken by China. By estimates of United States Geological Survey, the output of feldspar products in the country in 2007 reached 2.0 million tons. In 2011-2014, China manufactured 2.1-2.4 million tons of feldspar, in 2016-2017 the output increased to 3.5-4 million tons. In the last 2 years China reduced somewhat the rate of extraction of feldspar.

The USA is included into the ten largest producers of feldspar in the world. In the considered period (2000-2017) the maximum production of feldspar - 790-800 thousand tons/year - were noted in 2000-2003. In the next years a small reduction of volumes of production of feldspar, to 730 thousand tons in 2007, was observed. The economic crisis considerably influenced the release of these products - in 2009, 550 thousand tons of feldspar (75% of the level of 2007) were released. Production cutback happened due to a decline in demand for products of the ceramic and glass industry - the main consumers of feldspar.

In 2010-2012, according to United States Geological Survey, production of feldspar increased and amounted to 650 thousand tons in 2012, however in the next years it decreased to 550 thousand tons again, and in 2016 - to 470 thousand tons. In 2017-2019, the output remained at the level of 450-500 thousand tons. In the USA feldspar is extracted in 7 states, the largest developments are in Northern Carolina, Idaho, Virginia and California.

About 50% of all feldspar products are made by 5 leading world companies, each of which has a production capacity of more than 1 million tons feldspar concentrate per year: Gruppo Minerali Maffei SpA (Italy, the capacity is 3.0 million tons per year), Imerys SA (France, the capacity is 1.5 million tons per year) and the Turkish producers Kaltun Mining Co. (1.4 million tons per year), Esan Eczacibasi Industrial Raw Materials (1.2 million tons per year) and Cine Akmaden Madencilik Ticaret SA (1.4 million tons per year).

**Table 1. World production of feldspar products
in 2000-2019, mln tons**

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Turkey	1.20																			
Italy	2.50																			
China	no/d																			
India	0.11																			
Thailand	0.54																			
Russia	0.30																			
France	0.60																			
USA	0.79																			
Spain	0.43																			
S. Korea	0.33																			
Poland	0.17																			
Iran	0.20																			
Malaysia	0.03																			
Czech Republic	0.34																			
Mexico	0.33																			
Egypt	0.33																			
Germany	0.46																			
Total in the world	9.54																			

Source: Infomine based on data of USGS, BGS

The volume of the world export of feldspar raw materials in 2018 reached 11 million tons. The largest world exporters of feldspar are Turkey, Thailand and India (Table 2). Turkey exports about 80% of the feldspar products made in the country. According to the database of the UN, volumes of export of Turkey in 2007-2008 were 4.4-4.6 million tons of feldspar, in 2009 export deliveries reduced to 2.9 million tons, but in 2010 increased to 3.7 million tons and in 2011 reached 4 million tons. In 2016, the Turkish export of feldspar exceeded 5.5 million tons, in 2018 - reached 6.7 million tons. The main consumers of the Turkish feldspar are the European countries - Italy, Spain, Poland, etc. and also Russia.

Export supplies of feldspar of Thailand - the second world exporter - in 2010-2011 made 0.5-0.6 million tons. About 40% of export products are delivered to the UAE. Also, large recipients of feldspar from Thailand are Malaysia, Indonesia, Vietnam, etc. In 2013-2019, export of feldspar by Thailand increased and was at the level of 0.7-0.95 million tons.

The third place among exporters of feldspar products in recent years belongs to India. In 2018-2019, the country exported more than 600 thousand tons of feldspar.

The large world exporter of feldspar is China. In 2008 this country exported about 1 million tons of feldspar products, in 2010-2011 volumes of export deliveries were 0.8 million tons. The main sales markets of the Chinese feldspar are Vietnam, the Republic of Korea, Indonesia, Malaysia, etc. In 2013-2015, the Chinese export decreased to 600-680 thousand tons, in 2016-2019 - to 400-500 thousand tons, that is connected with a growth of internal consumption. At this, China gave the third place among exporters of feldspar to India.

Table 2. Volumes of export of feldspar products by the largest world exporters in 2008-2019, thousand tons

Country	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Turkey												
Thailand												
India												
China												
Ukraine												
Italy												
Czech Republic												
France												
Total												

Source: Infomine based on data of UN Data

The largest world importers of feldspar are Italy and Spain (Table 3). Due to the crisis, import of feldspar products in both countries reduced considerably: in 2009 in Italy - by 40% to the level of 2007, in Spain - by 54%. Since 2010, an increase in import of feldspar by these countries was noted - by 2016 Italy increased import of feldspar products by 50% in relation to 2009, and Spain - by 2.8 times. At this, the

feldspar imports by Spain in 2016 considerably exceeded pre-crisis indicators. In 2018-2019, each of the countries bought 2.7-2.8 million tons of import feldspar.

Table 3. Import of feldspar products by the largest world importers in 2008-2019, thousand tons

Country	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Italy												
Spain												
Russia												
UAE												
Poland												
Indonesia												
Malaysia												

Source: Infomine based on data of UN Data

The analysis of data on the world production and the foreign trade operations with feldspar allows to conclude that the largest consumers of feldspar products are Italy (6.7 million tons in 2019), Spain (3.3 million tons), India and China. Italy and Spain traditionally are global manufacturers of construction ceramics, and in China this industry promptly develops in recent years.

Japan, Poland, the Republic of Korea, the USA are also in the category of large consumers.

The general condition of the world market of feldspar is defined, mainly, by the position of the main consumers of these products – the ceramic and glass industries. As both the ceramics and glass are used, first of all, in construction, and this industry was considerably damaged at the global financial crisis, consequences of the crisis also affected the market of feldspar products. Recovery of construction happens at slow rates, the same is true for the production of feldspars. Nevertheless, experts predict positive changes, which will happen, first of all, due to emerging markets of the countries of Asia, the Pacific region and Latin America.

The prices of feldspar in the world market till 2017 remained rather stable (Figure 1). In 2018-2019, an increase in prices for feldspar products followed - according to USGS the price in the USA market increased by 45%.