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# **WORLD TITANIUM DEPENDENCE ON RUSSIA: ECONOMY, ARMY, AND GLOBAL RISKS**

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Russia is anticipating a sharp increase in domestic demand for titanium products, driven primarily by the need to replenish its stockpiles of weapons, military equipment, and missiles depleted in the war against Ukraine. Although the country holds 14.5% of the world's titanium reserves, it is forced to import 96% of its titanium raw materials due to the inefficiency of developing its own deposits.

At the same time, Russia's military-industrial complex is heavily reliant on titanium, as titanium alloys account for up to 50% of the weight of modern fighter jets. Following the full-scale invasion of Ukraine, Russia expanded the use of gray supply schemes through intermediary countries and accelerated efforts to develop domestic sources. This study identifies the critical vulnerabilities of Russia's titanium industry and proposes concrete measures to restrict the aggressor's access to strategic raw materials – steps that could significantly diminish its military capabilities.

## ⚠ KEY FINDINGS

### Geography of titanium deposits and production

- The main producers of ilmenite concentrate are China, Mozambique, Australia, and South Africa, while Australia, South Africa, Kenya, and Ukraine also produce significant amounts of rutile concentrate. Ilmenite and rutile are the main titanium-containing minerals.
- China, India, and African nations have increased their titanium trade with Russia, reinforcing China's dominance in the global titanium market.

### Titanium in Russia

- Russia possesses 14.5% of the world's titanium reserves but produces only 0.03% of titanium concentrates due to challenges in developing its deposits. The main reserve regions include the Komi Republic, Murmansk Oblast, and Zabaykalsky Krai. Despite its substantial reserves, Russia relies on imports for 96% of its titanium raw materials. Titanium is essential for the country's aviation, space, chemical, and defence industries.
- While Russia focuses on manufacturing titanium products, it faces persistent issues securing raw materials, primarily due to the complexity of developing and processing domestic deposits. The only notable potential lies in the Arctic zone and remote areas of the Far East and Siberia.
- Notably, 70.6% of Russia's titanium reserves remain unallocated, indicating a strong raw material base for future exploitation.
- Russia uses titanium in the production of equipment for assault troops, aircraft engines, body armour, and modern fighter jets, where titanium alloys account for up to 50% of the total weight. In missiles and jet engines, titanium provides high strength and resistance to high temperatures.
- The main players in the Russian titanium industry are companies associated with two state-owned corporations: Rosatom and Rostec. The largest titanium producers are PJSC VSMPO-Avisma, which accounts for up to 96% of Russia's titanium sponge production, and Chepetsk Mechanical Plant, which processes titanium raw materials. Other important players in the market are JSC Ruspolymet, JSC Stupinsk Metallurgical Company, JSC Solikamsk Magnesium Plant, JSC Uralredmet, etc.
- The Achilles' heel of Russia's titanium industry is its heavy reliance on imported titanium concentrate – especially from Ukraine, prior to the full-scale invasion. In response, Russia has intensified efforts to develop its own deposits and is increasingly sourcing concentrate from third countries. This shift is facilitated by intermediary firms, front companies, and complex "logistics schemes" involving European countries, Turkey, and China.
- Russia is now projecting a surge in domestic demand for titanium products, primarily driven by the need to replenish military stockpiles – including weapons, equipment, and missiles depleted in Ukraine. Additionally, the government's "import substitution" policy is accelerating this demand, aiming to reduce dependence on foreign materials across strategic sectors.

### Sanctions on titanium

- Currently, there is no comprehensive sanctions regime targeting titanium and its related products in trade with Russia, aside from restrictions on specific companies.
- In the absence of broader sanctions on Russian titanium processing and manufacturing firms – or on their executives and owners – Russia's titanium industry continues to expand production, particularly for the military-industrial complex and the nuclear sector.



- Experts note that all Russian enterprises producing titanium alloys rely on alloying ligatures<sup>1</sup> from Uralredmet JSC. A well-known saying in Russia goes: “Without Uralredmet, no rocket will take off.” This company is currently sanctioned only by the United States and Ukraine. Broader international sanctions on Uralredmet would likely have a significant impact on the entire Russian titanium industry.
- To obscure the final recipients of titanium products, raw materials are often imported into Russia through front companies with unrelated business activities, such as construction materials, food trade, or logging.
- The European Union remains heavily dependent on Russian titanium, primarily due to its critical role in the aviation industry.



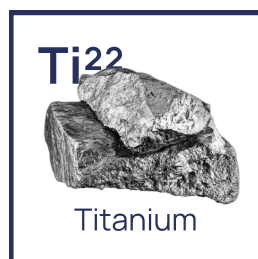
**Titanium** is one of the most common metals in nature, ranking as the ninth most abundant element in the Earth's crust. Among industrial metals, only aluminum, iron, and magnesium are more plentiful. Thanks to its exceptional strength, resistance to corrosion from seawater and chemicals, and its ability to form strong alloys with various other metals, titanium is a highly valuable material in global industry. It is 45% lighter than steel, twice as strong as aluminium, and has a high melting point of 1,668°C. However, its widespread use is limited by the high cost of extraction and processing.

**Only 5-10%** of global titanium reserves are used for metal production. It is as strong as steel but less dense, so it is used in alloys with other metals to build aircraft, spacecraft and rockets.<sup>2</sup> Titanium is also used in shipbuilding, power generation, food, medical and non-ferrous metallurgy industries because it can withstand extreme temperatures and moisture. Titanium tubes, in particular, are highly resistant to corrosion, making them ideal for use in ship and submarine hulls, as well as other structures exposed to seawater.

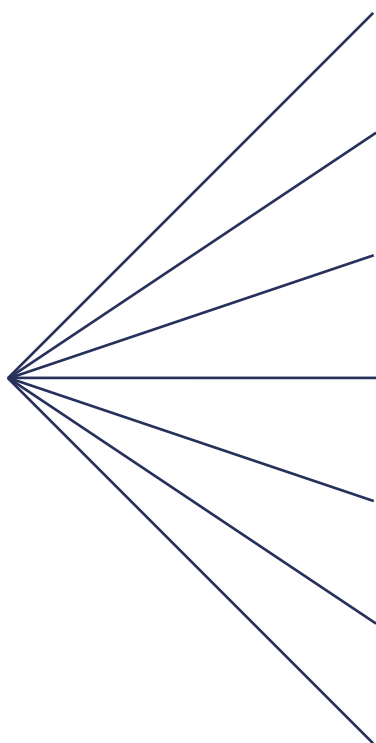
**The remaining 90-95%** of titanium raw materials are used to produce powdered titanium dioxide (TiO<sub>2</sub>) for the production of paper, plastics, ceramics, paints, enamels and other products. In addition, titanium is used to make everyday items such as laptops, bicycles, crutches, dental implants, and more. Powdered titanium is also used in pyrotechnics.<sup>3</sup>



Titanium is primarily found in the minerals anatase, brookite, ilmenite, leucoxene, perovskite, rutile and titanite (also known as sphene). Of these, it is mainly **ilmenite, rutile and leucoxene that are of significant economic importance.**<sup>4</sup>



## AREAS OF APPLICATION FOR TITANIUM



### Aviation

- aircraft, spacecraft construction
- jet engine production



### Military industry

- mortar plates
- plates for body armor
- parts for artillery systems



### Power engineering

- pumps
- reactors
- industrial filters
- centrifuges, compressors



### Food industry

- refrigerators
- barrels
- containers for transporting products



### Non-ferrous metallurgy

- chokes
- fan wheels
- gas pipelines



### Medical industry

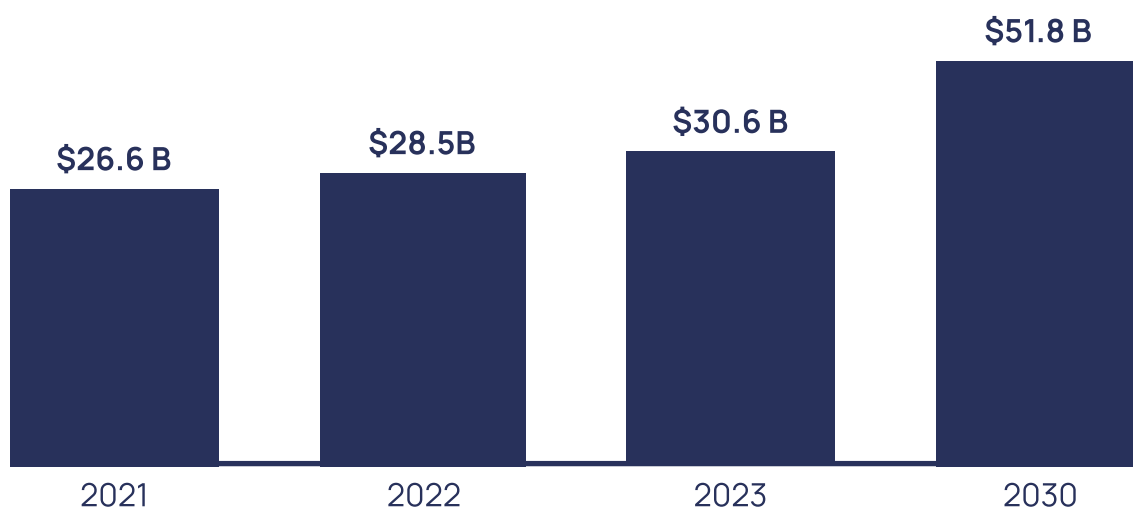
- crutches
- dental implants



### Manufacturing of everyday items

- paints
- paper
- bicycles
- computers

Due to its widespread use in various industries, titanium has formed a strong market. According to Statista, the global titanium market was worth **\$28.59 billion in 2022** and was estimated to reach **\$27-30 billion in 2023**.<sup>5</sup> The global titanium market is projected to reach nearly **\$52 billion by 2030**.



GLOBAL TITANIUM MARKET SIZE WITH FORECAST TO 2030, STATISTA

After enrichment of titanium ores, concentrates are produced based on the following minerals (includes average titanium content, % in terms of  $\text{TiO}_2$ , depending on the type of deposit):

- **ilmenite** (40-56 %  $\text{TiO}_2$ )
- **rutile**, анатаз і брукіт (90-98 %  $\text{TiO}_2$ )
- leucoxene (60-95 %  $\text{TiO}_2$ )
- loparite (38,3-41 %  $\text{TiO}_2$ )
- titanite (сфен) (30-42 %  $\text{TiO}_2$ )
- perovskite (35-55 %  $\text{TiO}_2$ ).

### RUTILE CONCENTRATE

is a dark brown sand used as a raw material to produce a white pigment, titanium dioxide ( $\text{TiO}_2$ ). Rutile is used in the manufacture of welding electrodes, titanium sponge and titanium metal, ceramics resistant to high temperatures, refractory dyes, and as a flux in metallurgy. Rutile concentrate is more expensive because it contains a much higher amount of titanium and is of higher quality, which is why it is consumed less globally.

### ILMENITE CONCENTRATE

(Ilmenite sand) is a product of the enrichment of ilmenite ore, which consists of small particles of ilmenite, a mineral containing titanium and iron oxides, which is black or dark brown and has a high density. Ilmenite concentrate is also used to produce the pigment  $\text{TiO}_2$ , which is widely used in the paint, paper, food and cosmetics industries.

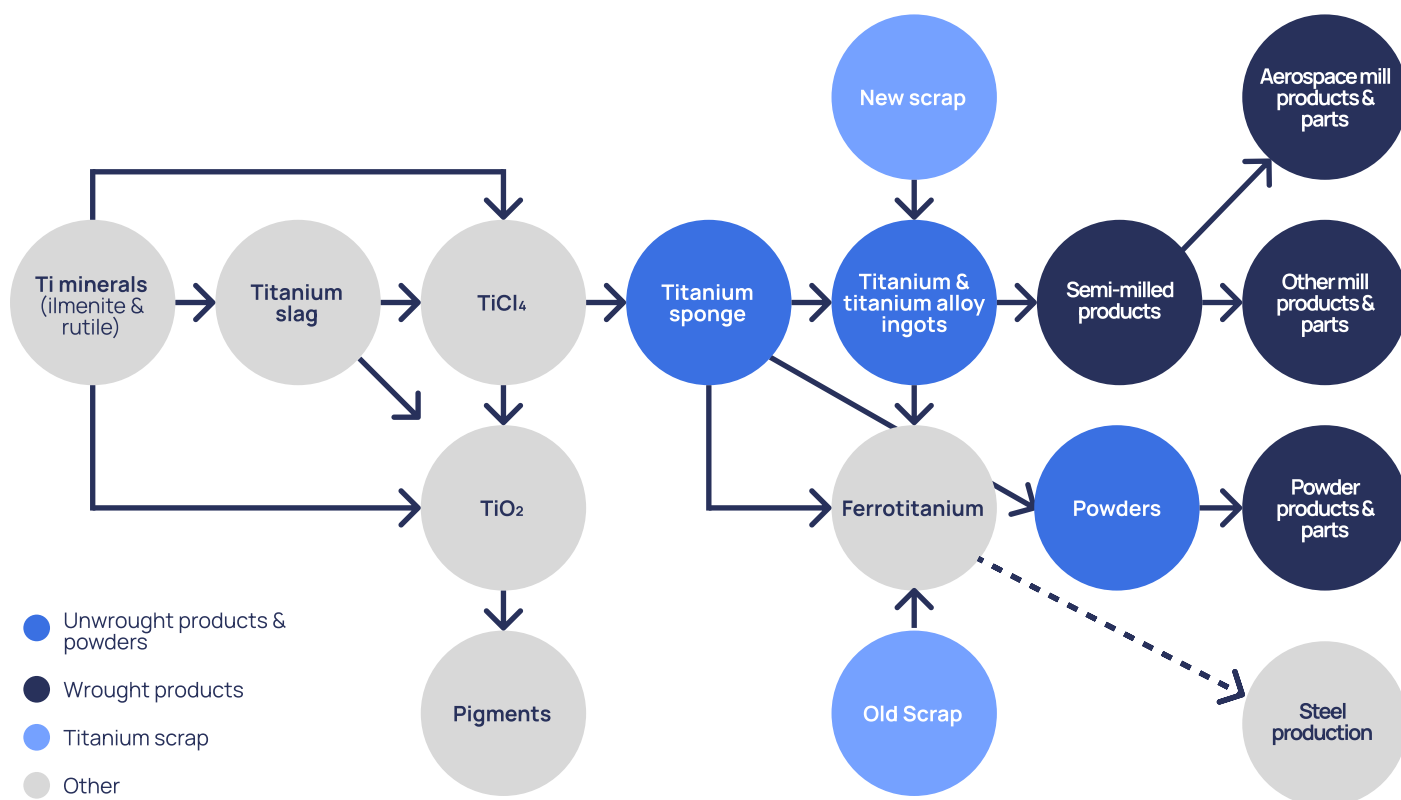
Industrial titanium is mainly extracted from ilmenite ( $\text{FeTiO}_3$  31.6%) and rutile ( $\text{TiO}_2$  60%), which are the most commonly used minerals in the world. Titanium concentrates are processed into titanium metal (titanium sponge) using magnesium-thermal technology and into pigmented titanium dioxide ( $\text{TiO}_2$ ) using sulphate and chloride technologies.



Ilmenite concentrates from Ukrainian deposits are considered the best raw material for sulphate processing.<sup>6</sup>

There is also a technology for the production of **synthetic rutile**, an analogue of titanium slag. Synthetic rutile is produced from low-quality ilmenite. Synthetic rutile is more efficient than natural one, and its processing is cheaper.

The process of mining and producing titanium products is complex and involves multiple stages, typically carried out by different companies or facilities. The production flow for titanium goods includes several distinct phases. **Titanium ore** is mined and enriched to produce titanium concentrate (ilmenite or rutile), which is then used to produce **titanium slag**, which is subsequently processed into **titanium sponge** through several steps. Titanium sponge is the primary metal stage of titanium. Russia is one of the world's top three producers of titanium sponge. The next processing stage is the melting of the sponge and/or **titanium scrap**, usually with alloying elements such as vanadium and aluminium.<sup>7</sup> This process produces **titanium ingots, slabs and titanium powders**. Ingots and slabs are used to make rolled metal products (pipes, wires, sheets and plates), as well as forgings, castings, and finished titanium parts and components (referred to as processed titanium, unlike the previous stages). The processing of titanium into finished products generates a large amount of scrap, which is also a valuable raw material.

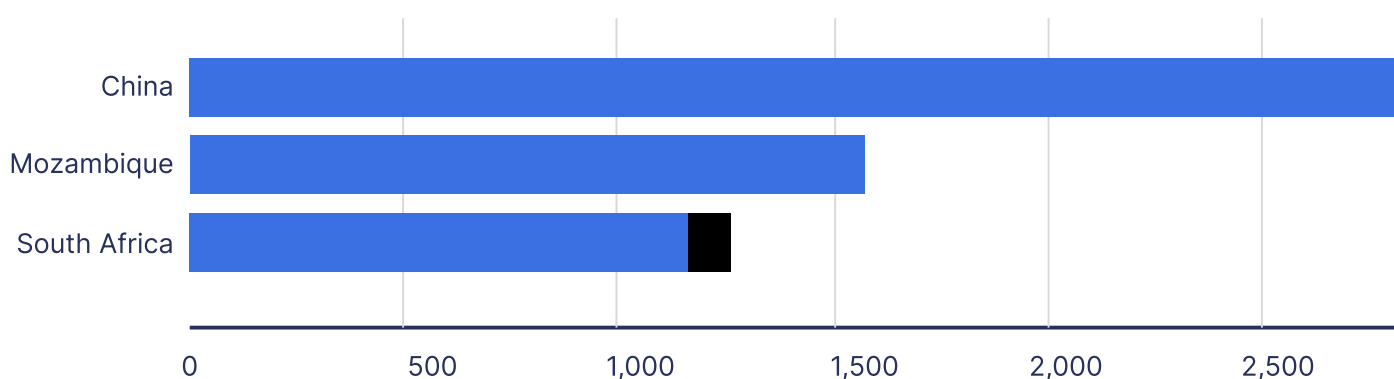


**TITANIUM VALUE CHAIN AND PRODUCTION SCOPE**  
Source: Joint Research Centre at the European Commission<sup>8</sup>

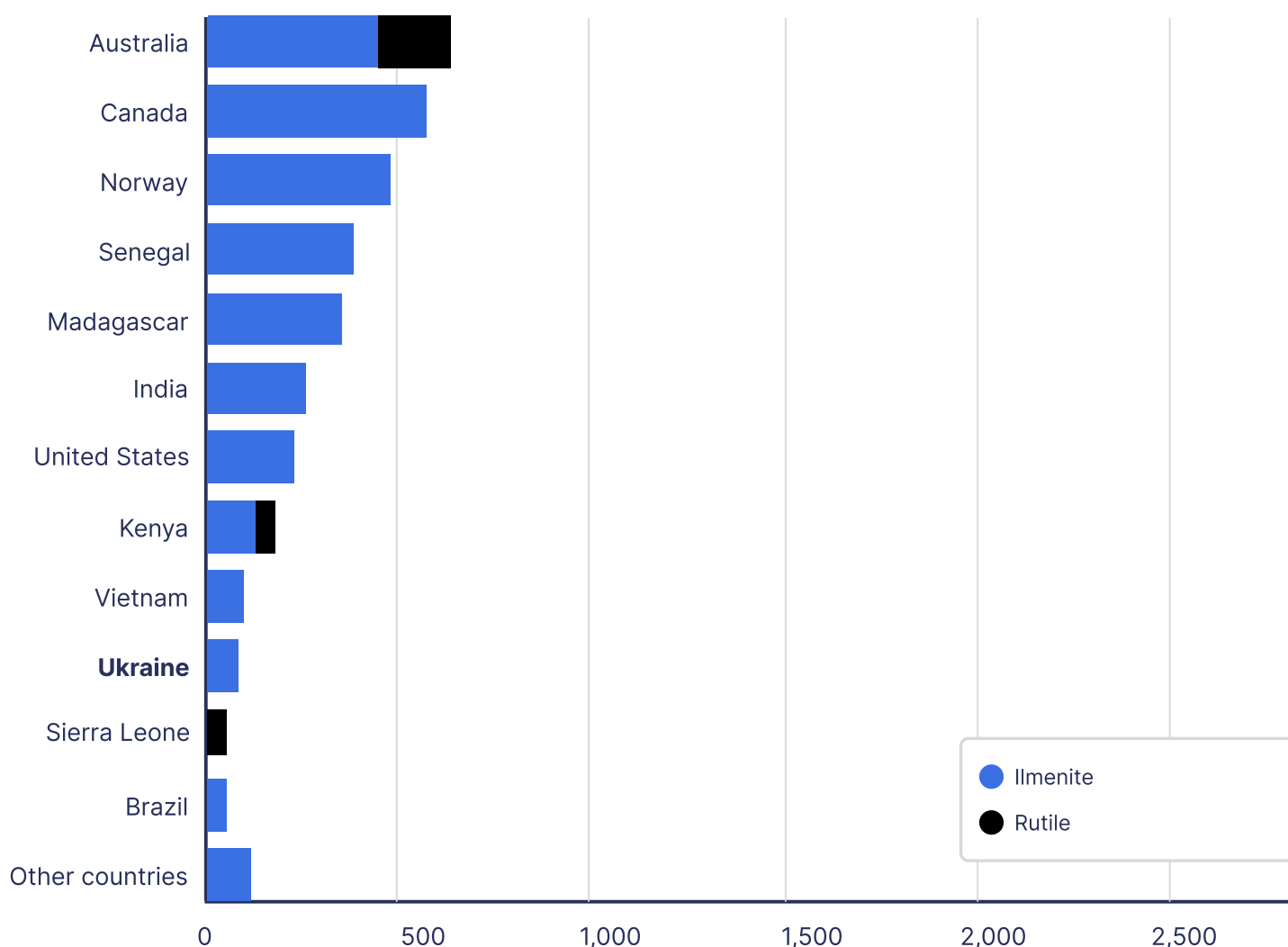
Titanium sheet is a form of pure titanium with minimal impurities and is one of the most commonly used types of titanium metal.

## TITANIUM DEPOSITS IN THE WORLD

As of 2022, total global reserves of titanium minerals were approximately **690 million tonnes of ilmenite and 55 million tonnes of rutile** (the most common minerals from which titanium is extracted). China has the largest total reserves of titanium minerals in the world. China's ilmenite reserves are equivalent to approximately **210 million metric tonnes of titanium dioxide**.<sup>9</sup> This means that all of China's reserves can be utilized to extract these quantities of titanium dioxide – a valuable material widely used in manufacturing. In 2023, China's production of ilmenite totalled approximately **3.1 million metric tonnes**, nearly twice the amount produced by Mozambique, the world's second-largest titanium mineral producer.<sup>10</sup> By 2024, global titanium mineral production reached around **9.2 million metric tonnes**, with ilmenite accounting for more than 90% of the total. Notably, the majority of the world's titanium output comes from countries considered politically unstable.







LEADING COUNTRIES IN THE PRODUCTION OF TITANIUM MINERALS IN THE WORLD IN 2023, STATISTA

The US is the world's largest exporter of titanium and titanium products. Meanwhile, China is the largest exporter of titanium ingots and titanium oxide. The European Union maintains a strong partnership with the United States in titanium trade, as the EU imports most US titanium products.<sup>11</sup>

Prices for titanium and titanium products can vary. For example, in 2022, the average Australian price for rutile with a minimum titanium dioxide content of 95% was US\$1,500 per metric tonne, and the average cost of one metric tonne of ilmenite was US\$290.<sup>12</sup> The price depends on the purity level, brand and processing stage of the product.

China, Mozambique, Australia, and South Africa mainly produce ilmenite concentrate; Australia, South Africa, Kenya, and Ukraine also produce large quantities of rutile concentrate.<sup>13</sup>

In the first half of 2022, fears of a potential shortage following Russia's invasion of Ukraine triggered a surge in the titanium market. Western companies ramped up their purchases of titanium ore, driving up prices for titanium sponge in the European market. However, prices began to stabilise by the end of the year.<sup>14</sup>

The EU does not produce primary titanium metal – such as titanium sponge or scrap – domestically. Some Member States do manufacture titanium ingots, but these rely on imported titanium sponge and/or scrap. Between 2014 and 2018, Russia accounted for 30% to 60% of the EU's titanium imports. However, this share has declined significantly in recent years.<sup>15</sup>

The world's largest titanium producers are the following companies: ATI (USA), DuPont Titanium Technologies (USA), Chemours (USA), National Titanium Dioxide Co. Cristal (Saudi Arabia), Huntsman Pigments (USA), Tronox, Inc. (USA), Kronos Worldwide, Inc. (USA), Sachtleben Chemie GmbH (Germany), Ishihara Sangyo Kaisha, Ltd. (Japan), PJSC VSMPO-Avisma Corporation (Russia), Timet (Titanium Metals Corporation, USA), The Kerala Minerals & Metals Ltd. (India), etc.

Russia has one of the world's largest titanium resource bases, accounting for 14.5% of global reserves. At the same time, the country's contribution to global titanium concentrate production is only 0.03%.<sup>16</sup>

There are about 30 titanium deposits in Russia, located mainly in the Central European part of the country, in Western and Eastern Siberia and in Primorye. Russia's largest titanium reserves are concentrated in the Komi Republic (50.2%), Murmansk Oblast (18%), and Zabaykalsky Krai (17.8%). As of January 1, 2023, Russia's balance sheet reserves of titanium were estimated at 580.3 million tonnes of titanium dioxide (TiO<sub>2</sub>).<sup>17</sup>

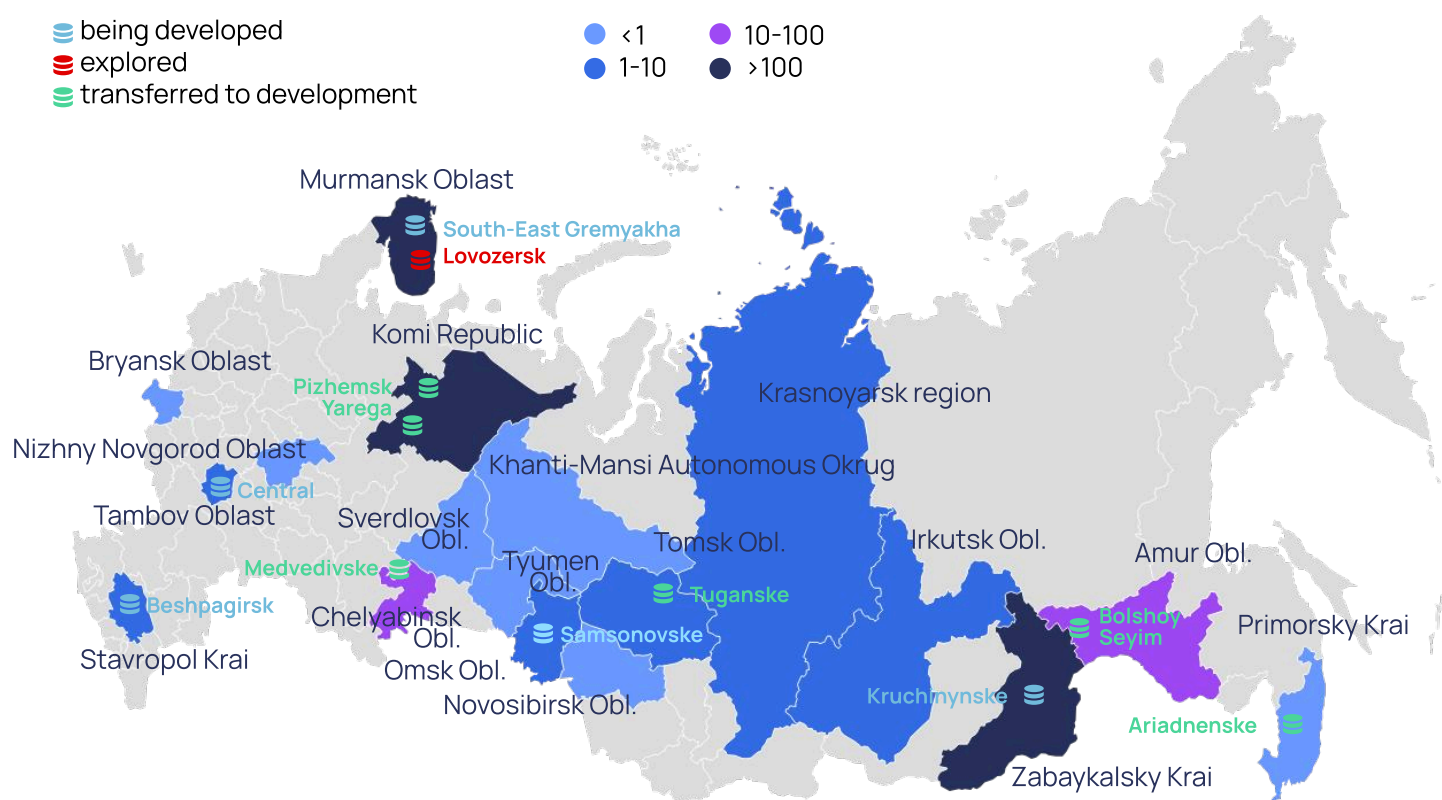
In 2022, titanium was mined at seven deposits in the Murmansk region.<sup>18</sup>

## Location:

-  being developed
-  explored
-  transferred to development

## Reserves, million tons TiO<sub>2</sub>:

-  <1
-  1-10
-  10-100
-  >100



## DISTRIBUTION OF TITANIUM RESERVES AMONG THE CONSTITUENT ENTITIES OF THE RUSSIAN FEDERATION (MILLION TONNES OF TiO<sub>2</sub>) AND ITS MAIN DEPOSITS<sup>19</sup>

It is not possible to launch titanium production quickly. Establishing the production chain requires first developing titanium deposits, followed by building the necessary infrastructure. This process occurs in several stages and depends on demand and long-term planning<sup>20</sup>:

-  **Stage 1.** Construction of a mining and processing plant (MPP) for ore mining and concentrate production. Implementation period: 2–3 years.
-  **Stage 2.** Construction of a chemical and metallurgical complex to process the concentrate into titanium dioxide and other products. Implementation period: 3–4 years.
-  **Stage 3.** Creation of a refining complex to separate rare earth elements (REEs) into separate compounds.

Russia specializes in the production of titanium products but faces significant challenges in securing raw materials due to difficulties in developing its own deposits. A large portion of titanium-bearing minerals – **such as titanium magnetite and titanite (sphene) – remains stored in facilities because of the lack of viable industrial technologies for their processing.**<sup>21</sup> Therefore, in 2022, 3% of reserves were being developed in the Russian Federation, with only 0.2% of titanium being extracted into concentrate. Another 26.4% of reserves were in the exploration or preparation stages, while a substantial **70.6% remained in the unallocated reserve fund.** Russia's main potential lies in hard-to-reach areas such as the Arctic zone, the remote regions of the Far East, and Siberia.

**The primary titanium concentrate deposits currently under development in Russia include:**



**The Tugansk ilmenite-zirconium sands deposit is being developed by JSC Tugansk Mining and Processing Plant Ilmenite,** an enterprise of the Rosatom Mining Division. It became the first titanium mining enterprise in the country. Rosatom's investments in the deposit have helped to cover about a third of Russia's titanium needs. Work is currently underway to increase production capacity to 6.9 million tonnes of ore sands per year.<sup>23</sup> If all these plans are implemented, Tugansk MPP will be able to become the main supplier of the world's largest titanium producer, PJSC VSMPO-Avisma Corporation.<sup>24</sup> The Tugansk deposit also produces zirconium. On January 15, 2025, the United States imposed sanctions on the company.<sup>25</sup>



**The Lovozersk loparite deposit is being developed by LLC Lovozersk MPP,** currently the only producer of rare earth concentrate in Russia, is located in the Murmansk region.<sup>26</sup> In May 2023, it became part of the Rosatom State Atomic Energy Corporation. The loparite mineral is mined there, which is a source of tantalum, niobium, titanium, and rare earth elements. Only the Lovozersk deposit is a source of titanium-containing loparite concentrate.<sup>27</sup> The only buyer of the Lovozersk MPP loparite concentrate is OJSC Solikamsk Magnesium Plant (SMP), which is also part of Rosatom. Titanium sponge and other materials are produced from the concentrate, which are then used for the production of electronics and microelectronics, aircraft and rocketry, as well as in the defence sector.<sup>28</sup> Currently, the MPP produces about 7.5 thousand tons of finished products per year, planning to increase this figure.



**Yarega oil and titanium deposit is better known as an oil one.** The company **Lukoil-Komi LLC** is engaged in mining here, mainly leucosene. In 2023, Rospatent issued a patent to the group of companies Russian Titanium Resources (Rustitan) for the technology of enrichment of titanium ores of the Pizhensk and Yarega deposits to obtain artificial porous rutile, wollastonite and quartz sand.<sup>29</sup> The technology developed by the company falls within titanium metallurgy and will be used for the industrial development of the world's largest Timan titanium-bearing province, whose depths contain over 80% of Russia's titanium reserves (20 billion tons).

**Fields planned for launch:**



**The Afrikand rare-earth metal deposit** is located in the Murmansk region. This is one of the largest perovskite-titanium-magnetite ore deposits in the world and one of the most promising in Russia. **LLC SGC Arkmineral** is the operator of the Russian project "Establishment of production of titanium dioxide, rare and rare-earth metals and thorium concentrate from perovskite concentrate of the Afrikand deposit". The nearby Kola NPP and Niva HPP will provide the necessary amount of electricity. Afrikand is connected by rail to the Murmansk and Kandalaksha seaports. The Afrikand development project involves establishing a chemical and metallurgical complex to produce not only titanium dioxide but also oxides of rare-earth elements, as well as niobium and tantalum compounds. These materials are strategic and play a crucial role in the defence industry: scandium is essential for aerospace components; yttrium is used in aviation guidance systems; lanthanum is vital for optical devices; and praseodymium, neodymium, samarium, and gadolinium are key in manufacturing lasers and magnets for rocketry and spacecraft.<sup>30</sup> In 2019, the Russian industry's demand for separated rare earth oxides was 1,100 tons, while production was only 250 tons. This highlights the importance of developing a domestic rare metal and rare earth industry, particularly through the development of the Afrikand deposit.<sup>31</sup>





**Afrikan deposit**, source – the Internet



Since 2022, the **Central titanium-zirconium deposit in the Tambov region** has been of significant interest to PJSC VSMPO-Avisma Corporation.<sup>32</sup> Developing the Tambov deposit will enable Russia to reduce its dependence on foreign sources of titanium raw materials. Discovered in 1959, the deposit is regarded as one of the largest in the world.



The **Pizhensk natural rutile deposit** is located in the Komi Republic. The implementation of the Pizhensk deposit development project can satisfy the Russian Federation's need for titanium, and will also create opportunities to supply rutile concentrate to countries "friendly" to the Russian Federation, in particular the People's Republic of China.<sup>33</sup> The deposit is considered strategically important. It is included in the Strategy for the Development of the Arctic Zone and Ensuring National Security of the Russian Federation for the period until 2035.<sup>34</sup> The launch of its development is planned for 2026. Estimated reserves are 300 million tons only at the mining site and another 1 billion tons in the resource base.<sup>35</sup> The development of this deposit, like Yarega one, will be part of the development of the Tymansk titanium-bearing province. Since 2011, Rustitan Group of Companies has been building a vertically integrated mining and metallurgical complex for the processing of titanium ores and quartz sandstones of the Pizhensk deposit.<sup>36</sup> Rustitan Group of Companies is investing \$500 million (52 billion rubles) in the development of the deposit.



**Pizhensk deposit**, source – the Internet

According to Rustitan Group, the current demand for titanium products in the Russian Federation is about 450 thousand tons.<sup>38</sup> At the same time, the Ministry of Industry and Trade of the Russian Federation notes that, given the growth of domestic aircraft manufacturing and chemical industry, the titanium market is expected to expand. In a few years, demand could reach 800–850 thousand tons annually.

## HOW DOES RUSSIA USE TITANIUM?

The titanium industry of the Russian Federation is a powerful and multifaceted sector that encompasses a wide range of enterprises involved in the extraction and processing of ores, as well as metallurgy and mechanical processing of metals. This complex also includes service companies responsible for the purchase, sale and marketing of strategic materials.

According to the Decree of the Government of the Russian Federation dated August 30, 2022 No. 2473-r, titanium is a strategic, but at the same time scarce type of mineral raw materials. In August 2024, within the framework of the XI International Forum of Technological Development "Technoprom-2024", a discussion took place on the further need for the development of new production of rare earth metals, as well as titanium. In September, Putin announced that Russia would limit the export of nickel, uranium and titanium.<sup>39 40</sup>

According to the All-Russian Research Institute of Mineral Raw Materials named after N. M. Fedorovsky, the domestic consumption of titanium ores and concentrates in Russia is 216 thousand tons, and they produce 8.8 thousand tons of raw materials.<sup>41</sup> As a result, the share of imports of titanium-containing raw materials in domestic consumption is 96%. At the same time, according to the Ministry of Natural Resources and Ecology of the Russian Federation, domestic consumption is 400 thousand tons (ilmenite concentrate constitutes about 380 thousand tons, rutile constitutes about 10 thousand tons, loparite constitutes about 13 thousand tons).<sup>42</sup>

To produce aerospace-grade titanium sponge or titanium alloys suitable for use in aviation and space technology, titanium ores must undergo complex, multi-stage processing. As a result, titanium-containing ore is not classified as a critical raw material, whereas metallic titanium is.<sup>43</sup>

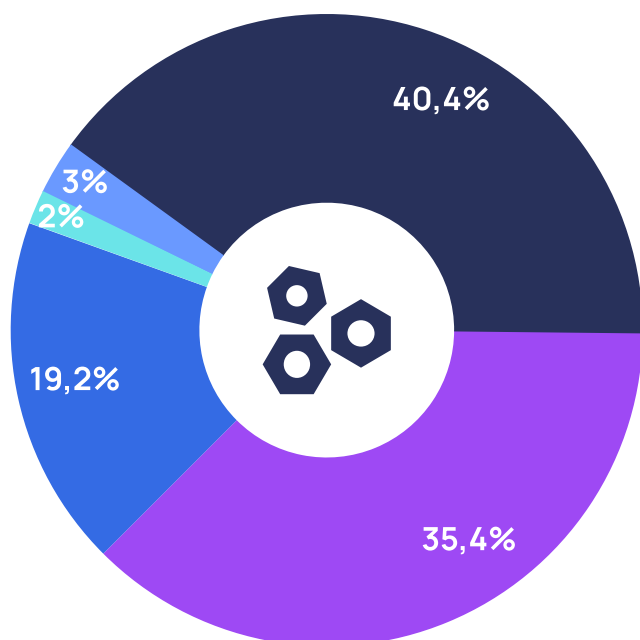
In 2023, the production volume of titanium ingots by Russian companies was 18% higher than in 2022, which may indicate either problems with the supply of imported ingots or an increased need for them for further warfare.<sup>44</sup>

The main consumption markets for titanium and titanium alloys in Russia are<sup>45</sup>:

- **aerospace** (aircraft, helicopter, rocket and engine manufacturing);
- **industrial** (shipbuilding, energy, chemical engineering, non-ferrous metallurgy).

At the Titanium-2024 conference, the head of the marketing department at PJSC VSMPO-Avisma Corporation reported that in 2023, the aerospace sector accounted for 59% of titanium consumption.<sup>46</sup> Specifically, over 40% of titanium products were used in the engine market, while more than 19% were directed toward the aircraft, helicopter, and space industries. General industrial applications accounted for 35% of usage, approximately 2% was used in the energy sector, and 3% served the needs of non-ferrous metallurgy and chemical engineering. Additionally, smaller volumes were supplied to research institutes, equipment developers, and service centres.

#### TITANIUM CONSUMPTION IN THE RUSSIAN FEDERATION, 2023



#### Distribution by industry:

- **40,4%** Engine building
- **35,4%** General industry
- **19,2%** Aircraft and space
- **3%** Non-ferrous metallurgy, chemical engineering
- **2%** Energy

The primary consumers of titanium products in the Russian aircraft manufacturing sector are **PJSC United Aircraft Corporation (UAC)** and **JSC United Engine Corporation (UEC)**, which produce aircraft and engines for civil, transport, special, and military applications.<sup>47</sup>



## THE IMPORTANCE OF TITANIUM FOR THE RUSSIAN MILITARY-INDUSTRIAL COMPLEX



Titanium metal is an indispensable element in the production of Russian weapons. The high domestic demand for titanium products is currently driven by the need to replenish the arsenals of weapons used in the war against Ukraine.

Titanium and its alloys are exceptionally well suited for equipping airborne and assault forces. They are used to produce a wide array of military hardware, including<sup>48</sup>:



mortar tubes



high-quality materials for  
barrels, nozzles, firing pistons,  
and gun mounts



parts for artillery  
systems



protective clothing  
and helmets



plates for  
body armour



aircraft engines



some firearm  
parts, etc



### AVIATION

In aviation, titanium alloys account for 35% to 50% of the total weight of **fighter aircraft**. Modern aircraft (Su-35) use about 50% of titanium products. The main parts of combat aircraft (spars, stringers and butt joints) are made of titanium. The same alloys are also used in landing gear structures, flap fasteners and power elements, wings and stabilisers, and supersonic aircraft bodies.<sup>49</sup>



1) Su-35; 2) VD-7M engine for the Tu-22 supersonic bomber, photo from the Internet



## ENGINES

**Jet engine** components subject to high-temperature loads are made exclusively of titanium. Titanium is used to manufacture parts for AL-31F (Su-27/30/34), AL-41F-1S (Su-35), NK-12 (Tu-95), NK-32 (Tu-160), NK-25 (Tu-22M3) and D-30F6 (Mig-31) **aircraft engines**.

## MISSILES

All Russian combat **tactical missiles** contain titanium parts. In particular, the share of such parts in the Kh-31PD anti-radar missile is 30%. The Kalibr and Kh-47M2 Kinzhal missiles contain 50-60% titanium, and the Kh-101 contains about 70% titanium components. The warheads of the missiles are made of titanium alloy ingots. The body of the final compartment of the missile, which houses the solid-fuel engine, is also made of titanium. In addition to their use in the Avangard missile system, titanium alloys are planned for use in the maneuvering unit of the new Sarmat intercontinental missiles, as well as in the Zircon hypersonic anti-ship missile.<sup>50</sup>

Titanium (IV) chloride is used by the military to create smoke screens, in particular with the help of smoke bombs, grenades, mines, shells, bombs, and smoke-generating equipment.

## RUSSIAN COMPANIES RELATED TO THE TITANIUM INDUSTRY

Most of the Russian titanium market players are part of or controlled by the two most powerful Russian sanctioned corporations:

1. **State Atomic Energy Corporation Rosatom;**
2. **State Corporation Rostec.**

This allows for intra-industry coordination of long-term plans, commodity flows and investment financing. Four major companies manufacture titanium products in Russia<sup>51</sup>:

### JSC STUPINSK METALLURGICAL COMPANY

JSC Stupinsk Metallurgical Company (SMK) specialises in the production of metal parts made from heat-resistant nickel and titanium alloys and special steels for the aviation industry. It is Russia's leading manufacturer of high-tech components for such industries as space, energy, mechanical engineering, shipbuilding, transport, oil and gas, and mining. SMK is a supplier of casting alloys and discs for engine manufacturers and the only Russian producer of special alloys required for the construction of supersonic strategic bombers. SMK's products are used in all Russian aircraft: in the engine designs of MiG and Su fighter jets, An-124, An-225, Il-96 transport aircraft, Be-200 amphibious aircraft and others.

SMK is the largest supplier to UEC-Saturn, a developer and manufacturer of cruise missile engines for Kalibr and Iskander-K systems, as well as X-101, X-59 (X-55, X-555, 3M-10, X-59, X-101/102, X-35 cruise missiles).<sup>52</sup>

Also among the clients of SMK:

- **JSC Aviation Gearboxes and Transmissions - Perm Motors**, one of the largest enterprises in the Russian rocket and space industry, specialising in the production of liquid rocket engines for the first stage of medium and heavy launch vehicles;
- **PJSC UEC-Ufa Engine Manufacturing Association** is an innovative enterprise engaged in the development, production and after-sales service of gas turbine engines for military aviation;

- **PJSC Proletarsky Zavod**, specialising in ship and power engineering, produces ship mechanisms, systems and complexes for military and civilian vessels;
- **Balashikhinsky Foundry and Mechanical Plant** is one of the largest aircraft repair plants in Russia, specialising in the manufacture of aircraft wheels for military and civilian aircraft and helicopters;
- **Zelenodolsky Gorky Plant**, which manufactures missile boats, including the first ship of the Russian Navy called Dagestan.

SMK currently lacks its own raw material base and therefore relies on imports to meet its needs. According to customs data, since the start of the full-scale invasion of Ukraine, 11% of the company's supplies have been raw titanium and titanium powders. SMK also imports a lot of equipment, components and spare parts to run its steel and metalworking operations.

**The company has been under Ukrainian sanctions since 9 May 2025.<sup>53</sup>**



### JSC CHEPETSK MECHANICAL PLANT (CMP)

Chepetsk Mechanical Plant (CMP) processes loparite concentrate using nitric acid technology and aims to produce niobium and tantalum pentoxides and crude titanium dioxide in the future.<sup>54</sup> The plant is part of the TVEL Concern of Rosatom State Corporation. The plant is **the world's largest and the only producer of zirconium and its alloys**, hafnium, calcium and low-temperature superconducting materials and products in Russia. Today, CMP accounts for 18% of the global zirconium rolled products market and 70% of the Russian titanium welding wire market.<sup>55</sup> At the end of 2024, CMP launched the production of titanium powders for 3D printing. Previously, Russian manufacturers used imported materials and 3D printers for powder printing, but now they have learnt to produce both equipment and powders on their own.<sup>56</sup>

The plant receives titanium sponge from the Solikamsk Magnesium Plant and sells its products to Western countries through the so-called 'German' distributor Hermith GmbH, the Turkish Titan 2 İc İnşaat Anonim Şirketi and its Russian subsidiary.<sup>57</sup> In 2023, the plant received a licence to design and manufacture equipment for nuclear facilities, radiation sources, storage facilities for nuclear materials and radioactive substances.<sup>58</sup>

**The company is only subject to Ukrainian sanctions.<sup>59</sup>**



### PJSC VSMPO-AVISMA CORPORATION

About 90% of the total amount of titanium ingots smelted in Russia in 2021 was produced by PJSC VSMPO-Avisma Corporation, a part of the sanctioned Rostec State Corporation, whose main activity is the development of the Russian defence industry.<sup>60</sup> Today, the company accounts for 96% of all titanium sponge produced in Russia.<sup>61</sup> It is the country's main producer of aerospace-quality sponge titanium and is considered the world's largest in terms of installed capacity. Another key player in the titanium complex is Uralredmet JSC, whose ligatures<sup>62</sup> are used by all Russian titanium enterprises producing titanium alloys.

PJSC VSMPO-Avisma Corporation is the only titanium company in the world that carries out a full production cycle from raw material processing to the manufacture of highly processed end products.

The corporation supplies products to 50 countries, is deeply integrated into the global aerospace industry and is a strategic supplier for many companies. VSMPO-Avisma carries out its main foreign operations through its subsidiaries in Germany, the UK, the USA, China and Switzerland.<sup>63</sup> The aforementioned German company Hermith GmbH, registered by 'immigrants from Russia' in Munich, also has long-term dealer contracts for supplies to Europe with PJSC VSMPO-Avisma Corporation, TVEL JSC (Rosatom), and Ruspolymet JSC. Hermith GmbH has two subsidiaries in Russia: Hermit Aerospace LLC and Scientific and Technical Centre TitanTech LLC.

|                                                                                                                                            |                                                                                                                                     |                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>VSMPO TiRus Ltd   GREAT BRITAIN</b><br>Unit 12, The io Centre, Nash Road,<br>Redditch B98 7AS, United Kingdom<br>Phone: +44 1527 514111 | <b>TiRus International SA   SWITZERLAND</b><br>Av. Gratta-Paille 1, 1018 Lausanne,<br>Switzerland<br>Phone: +41 21 641 5500         | <b>TiRus China</b><br>Rm.2006, Building A, Phoenix Place, No.A5<br>Shuguangxili, Chaoyang District, Beijing<br>100028, China<br>Phone: +86 10 84554688 |
| <b>VSMPO - TiRus, US (Headoffice)</b><br>1745 Shea Center Drive, Suite 330,<br>Highlands Ranch, CO 80129<br>Phone: +1 720 746 1023         | <b>TiRus - US (Eastern Service Center - Pittsburgh, PA)</b><br>401 Riverport Drive, Leetsdale, PA 15056<br>Phone: +1 (412) 262-8898 |                                                                                                                                                        |

**VSMPO-Avisma Corporation's offices around the world** (UK, Switzerland, China, USA, Germany), company website

PJSC VSMPO-Avisma Corporation is the largest supplier of titanium for the Russian military-industrial complex, in particular for the following Russian enterprises:

- **PJSC Strela**, which manufactures components and assemblies for Yak-130 trainer aircraft, MiG-29, Su-30, Su-35 fighters, Su-34 bombers, latest generation T-50 fighters, Sukhoi Superjet 100 civilian domestic airliner and UAVs<sup>64 65</sup>;
- **JSC Tupolev**, a subsidiary of the Russian Defence Industry Corporation, is a leading Russian designer and manufacturer of strategic bombers and long-range aircraft;
- **PJSC Amur Shipyard** is a Russian state-owned enterprise that designs and builds most of Russia's warships<sup>66</sup>;
- **FSUE 'Russian Federal Nuclear Centre' All-Russian Research Institute of Experimental Physics'** is a Russian state-owned research and production enterprise whose main task is to maintain the reliability and safety of Russia's nuclear weapons.<sup>67</sup>

**PJSC VSMPO-Avisma Corporation is subject to sanctions imposed by the United States (export control), Canada, New Zealand, and Ukraine.**<sup>68</sup> Due to the period of turbulent changes in US policy in early 2025, VSMPO-Avisma's shares soared for a while, as some companies began to count on sanctions relief for the Russian market.



## JSC RUSPOLYMET

Ruspolymet JSC is one of the world's largest ring-rolling companies. It is one of the most modern metallurgical and metalworking enterprises in Russia, featuring a full production cycle — from smelting to the manufacture of finished products — serving the machine-building, aerospace, nuclear, energy, and other industries. The company's German subsidiary **Ruspolymet GmbH** is responsible for exports and imports of all Ruspolymet Group companies.<sup>69</sup>

**Vacuum Metallurgy Plant LLC** is part of Ruspolymet JSC. In 2020, the plant launched the production of titanium ingots for aircraft engines. The main consumers of products made from titanium ingots at this plant are the United Engine Corporation (UEC), the United Aircraft Corporation (UAC) and other Russian military industrial complex enterprises.

**Grancom LLC**, a subsidiary of Ruspolymet JSC, is Russia's largest and one of the world's largest and most technologically advanced producers of metal powders and alloys, producing and supplying powders and granules, as well as parts made from them, for the aerospace industry, nuclear engineering, and shipbuilding.

**The Russian company is under US and Ukrainian sanctions.**<sup>70</sup>

Other major players supporting the Russian titanium industry include the following companies:

- **OJSC Solikamsk Magnesium Plant** is Russia's second-largest producer of sponge titanium, tantalum, niobium, and rare earth elements. The plant uses loparite concentrate from the Lovozersk MPP and is part of Rosatom. In 2023, the plant started using rutile concentrate from Tugansk MPP to increase titanium sponge production. Currently, SMP produces 100% of group concentrates (compounds of rare earth elements), niobium and tantalum, 75% of magnesium and 4% of titanium sponge in Russia and has plans to increase the plant's capacity.<sup>71</sup>
- **JSC Uralredmet** is the world's largest producer of ligatures, which are essential for the production of titanium alloys. It is subject to Ukrainian sanctions.<sup>72</sup>
- **KV-Titan** is Russia's largest producer of titanium melting furnaces.
- **LLC Siberian Titan** is building a pigment titanium dioxide plant using a unique fluoride technology in Tomsk Oblast at the site of the Siberian Chemical Plant (SCP). Russia has no pigment titanium dioxide production of its own (except for the temporarily seized Crimean Titan). As of September 2024, the construction project was suspended due to lack of funds.<sup>73</sup>

## ANALYSIS OF IMPORTS AND EXPORTS OF TITANIUM RAW MATERIALS AND ITS PRODUCTS IN THE RUSSIAN FEDERATION FROM 2023 TO THE FIRST QUARTER OF 2024

For the analysis of imports and exports, the supply of titanium and its products under the following HS-codes was investigated:

| HS-code                | Name                                   |
|------------------------|----------------------------------------|
| 2614000000             | Rutile/ilmenite concentrate            |
| 3824999608, 26140030   | Synthetic rutile                       |
| 8108200001, 8108200003 | Titanium sponge                        |
| 2620996000             | Titanium slag                          |
| 8108200005             | Titanium powder and granules (tablets) |
| 8108905008             | Titanium sheets (plates)               |
| 8108200006             | Titanium ingots, unprocessed titanium  |
| 8108300000             | Titanium scrap                         |
| 8108                   | General for titanium                   |

The analysis is not exhaustive and requires deeper research in order to understand the full picture of trade in titanium and its products from the Russian Federation. Probably, not all supplies were recorded in the studied customs database. Also, some products could be incorrectly marked with wrong HS-codes by the importers/exporters.



## EXPORTS FROM THE RUSSIAN FEDERATION IN 2024



According to customs data, from January to July 2024, Russia exported titanium and its products worth **\$120,741,471** to the following countries:

| #  | Country                    | Total sum, \$   | %      |
|----|----------------------------|-----------------|--------|
| 1  | France                     | \$33,406,925.79 | 27.67% |
| 2  | People's Republic of China | \$16,121,298.41 | 13.35% |
| 3  | USA                        | \$13,429,874.41 | 11.12% |
| 4  | Germany                    | \$11,947,841.79 | 9.9%   |
| 5  | Great Britain              | \$11,303,604.91 | 9.36%  |
| 6  | Belgium                    | \$5,361,753.71  | 4.44%  |
| 7  | Switzerland                | \$3,440,959.20  | 2.85%  |
| 8  | Brazil                     | \$2,912,788.52  | 2.41%  |
| 9  | Spain                      | \$2,670,464.14  | 2.21%  |
| 10 | Italy                      | \$2,472,786.66  | 2.05%  |

A third of all shipments were made to France. In addition to the countries mentioned in the table, deliveries were also made to Austria, the UAE, Turkey, Azerbaijan, Estonia, Singapore, etc. The main companies purchasing the products were foreign subsidiaries of the Russian PJSC VSMPO-Avisma Corporation in Germany, the USA, China and Britain (88%). Among the companies is also the Indian Hindustan Aeronautics Ltd, which is one of the largest manufacturers of defence and aerospace products in the world. In particular, it carries out major repairs of Russian Su-30 fighter aircraft under licence and repairs MiG-21/27M, BIZON, etc.<sup>74</sup>

Of the entire variety of titanium products, titanium bars (48.98%), plates and sheets (39.18%) prevailed in Russian deliveries abroad.

Russian companies that exported titanium are primarily VSMPO-Avisma Corporation (94.55%), as well as AT-Spetstekhnologiya LLC (1.2%), which supplies ferrous and non-ferrous metallurgy products to foreign customers and the Russian military-industrial complex in the field of aircraft engine construction, rocket and space industry, shipbuilding, production of weapons and military equipment for the ground forces under contracts with Rosoboronexport JSC<sup>75</sup>, and some others.

A year earlier, for entire 2023, exports of titanium products from the Russian Federation were three times higher and constituted **\$362,722,019**. The distribution by countries and export products did not differ much.

In 2024, Russia significantly increased its supplies of titanium to China – by 44%.<sup>76</sup>

## IMPORTS TO THE RUSSIAN FEDERATION IN 2024

According to customs data, from January to July 2024, Russia imported titanium and its products for almost the same amount as it exported – **\$125,776,725** – from the following countries:

| #  | Country                    | Total sum, \$   | %      |
|----|----------------------------|-----------------|--------|
| 1  | People's Republic of China | \$65,344,615.37 | 51.95% |
| 2  | India                      | \$10,595,882.45 | 8.42%  |
| 3  | Vietnam                    | \$8,979,675.90  | 7.14%  |
| 4  | EU                         | \$5,609,529.32  | 4.46%  |
| 5  | Turkey                     | \$3,706,195.34  | 2.95%  |
| 6  | Denmark                    | \$3,673,696.38  | 2.92%  |
| 7  | Germany                    | \$3,581,322.79  | 2.85%  |
| 8  | Spain                      | \$3,355,239.94  | 2.67%  |
| 9  | Sweden                     | \$2,693,051.37  | 2.14%  |
| 10 | USA                        | \$2,586,106.53  | 2.06%  |

More than half of the titanium products supplied to Russia in 2024 were made by China. India and Vietnam also have a significant share.

Russia mainly needed synthetic rutile (57.34%), titanium ore (15.53%), titanium slag (10.37%) and titanium plates (7.15%). Among the companies that imported titanium products were:

| #  | Importers                                   | Total sum, \$   | %      |
|----|---------------------------------------------|-----------------|--------|
| 1  | VSMPO-Avisma Corporation PJSC               | \$29,920,779.02 | 23.79% |
| 2  | Ural Mining and Metallurgical Company LLC   | \$5,547,513.62  | 4.41%  |
| 3  | Uranium One Group JSC                       | \$4,819,680.00  | 3.83%  |
| 4  | Enerium JSC                                 | \$2,642,533.25  | 2.1%   |
| 5  | Shchyolkovo Agrokhim JSC                    | \$2,517,785.55  | 2%     |
| 6  | Asylab LLC                                  | \$2,397,975.44  | 1.91%  |
| 7  | Elektrosvkavmontazh Corporation LLC         | \$1,813,761.00  | 1.44%  |
| 8  | Esab LLC                                    | \$1,687,216.30  | 1.34%  |
| 9  | Zeskmy LLC                                  | \$1,674,145.00  | 1.33%  |
| 10 | Trading and Industrial Company "Leader" LLC | \$1,472,697.38  | 1.17%  |

A number of Chinese companies acted as suppliers (Table 4). Among them is the Chinese subsidiary of ESAB, an American-Swedish industrial company of equipment and materials for welding and cutting metals. In Russia, the company has more than 150 distributors in all federal districts, two factories and the ESAB technology center in Krasnogorsk in the Moscow region. The Russian ESAB is a supplier to sanctioned enterprises related to the Russian military-industrial complex: JSC Special Design Bureau of the Ministry of Defence of the Russian Federation, JSC Vyborg Shipbuilding Plant, JSC Baltiysky Zavod, etc.

Another supplier, Dijkstra Logistics Fze (UAE), was registered in 2021 by Russian Vasiliy Startsev.<sup>77</sup> The company is one of the main suppliers of titanium concentrate, sponge and slag for Avisma and titanium sponge for JSC Uranium One Group. Dijkstra Logistics Fze vessels<sup>78</sup> are involved in the supply of ilmenite to the temporarily occupied Crimea.<sup>79</sup> In 2022, the company supplied titanium concentrates to the Russian Federation with declared origin from Sri Lanka, Mozambique, and Vietnam.

| #  | Suppliers                                                        | Total sum, USD  | %      |
|----|------------------------------------------------------------------|-----------------|--------|
| 1  | Tianjin Chengan International Trading Co Ltd                     | \$13,047,490.00 | 10.37% |
| 2  | Vsmo Tirus Beijing Metallic Materials Ltd                        | \$9,666,423.22  | 7.69%  |
| 3  | Dcw Ltd                                                          | \$7,165,780.00  | 5.7%   |
| 4  | De Nora Italy Srl                                                | \$5,547,513.62  | 4.41%  |
| 5  | Dijkstra Logistics Fze                                           | \$4,819,680.00  | 3.83%  |
| 6  | Cytiva Sweden Ab                                                 | \$2,632,209.75  | 2.09%  |
| 7  | Kesa Kimya Ticaret As                                            | \$2,517,785.55  | 2%     |
| 8  | Shenzhen Eastitec Technology Co Ltd                              | \$1,813,761.00  | 1.44%  |
| 9  | Esab Welding & Cutting Products Shanghai Management Co Ltd China | \$1,686,711.05  | 1.34%  |
| 10 | Xi An Baoti Aerospace Materials Co Ltd                           | \$1,674,145.00  | 1.33%  |
| 11 | Too Oil And Fat Company                                          | \$1,648,314.87  | 1.31%  |
| 12 | Shandong Yanggu Huatai Chemical Co Ltd                           | \$1,584,845.54  | 1.26%  |
| 13 | And Endustriyel Hammaddeler Dis Ticaret Ltd Sti                  | \$1,472,697.38  | 1.17%  |
| 14 | Hangzhou Y&H International Forwarding Agency Co Ltd              | \$1,377,818.30  | 1.1%   |
| 15 | Jr Speciality Chemicals Private Limited                          | \$1,328,268.82  | 1.06%  |

In 2023, Russia imported titanium products worth \$436,556,195, compared to \$522,154,239 in 2022. Since the start of the full-scale invasion, imports of titanium products into the Russian Federation have been steadily declining. Regarding the sources of these imports, Vietnam and Mozambique accounted for one-third of the market in 2023, Sri Lanka for 24%, and China for nearly 12%. Over the year, China increased its titanium exports to Russia more than fourfold, while the other countries mentioned significantly reduced their supplies.

The Omani project for the production of titanium slag in the **Sohar Free Zone** is currently under construction. Its significance for Russia lies in the fact that, once completed, it will help eliminate Russia's critical dependence on Ukrainian raw materials. The project also benefits from a strategically favourable logistical location: shipments can be transported via the Suez Canal and the Bosphorus to the port of Novorossiysk, and from there along the Don, Volga, and Oka rivers to the city of Berezniki, home to the production facilities of PJSC VSMPO-Avisma Corporation. In December 2023, Russia and Oman ratified an agreement on the avoidance of double taxation, which may signal a warming of bilateral relations.

According to customs data, in 2023 the volume of Russian imports of **titanium concentrates** dropped by half compared to 2022. This decline could indicate that domestic needs are being met through the extraction of raw materials from Russia's own deposits. Alternatively, it may suggest the presence of "gray exports" of strategic raw materials into the country. Another possibility is a genuine reduction in trade with Russia due to foreign suppliers seeking to avoid potential sanctions and reputational risks. However, this trend appears inconsistent with the still high levels of titanium-dependent production within the country.<sup>80</sup>

| # | Year                     | Amount of titanium raw material imports<br>in \$ | %      |
|---|--------------------------|--------------------------------------------------|--------|
| 1 | 2022                     | \$162,677,321                                    | 10.37% |
| 2 | 2023                     | \$80,877,153                                     | 7.69%  |
| 3 | 2024 (January-September) | \$19,528,193                                     | 5.7%   |

In 2023, the largest importer of **titanium sheet** was the Russian trading company LLC Snabkomplekt, which demonstrates atypical behaviour for the company on the market. According to the registers, LLC Snabkomplekt specializes in wholesale trade in a wide range of goods (textiles, food, tobacco products, cars, parts, furniture, pharmaceuticals, household appliances, etc.). In 2022, the company imported almost 50 tons of titanium sheet, and in 2023 – twice as much – over 116 tons.

Among the importers of titanium sheet are also companies that supply the Russian military-industrial complex or are involved in providing logistical support to it: LLC Spetsmetallmaster Group of Companies, NAO PKP Rosteckom, LLC Upravlyayuschaya Kompaniya Prommashtekhnologiya, LLC Dalnevostochny Opt Tsent, LLC BVB-Alliance, LLC Torgovaya Kompaniya Aktivista, etc.

## SANCTIONS ON THE TITANIUM INDUSTRY

In the absence of significant sanctions pressure, the titanium complex in the Russian Federation is increasing production, primarily for the military-industrial complex and nuclear energy. The number of titanium sponge producers that can meet high standards is limited to a few Japanese and Kazakh companies. And, of course, the Russian PJSC VSMPO-Avisma Corporation.<sup>81</sup>

In 2022, Russian titanium was removed from the proposals for inclusion in the sanctions lists at the last moment. This decision was blocked by France and other EU member states, due to the dependence of Airbus, the largest manufacturer of commercial jet aircraft. So, Russian titanium companies have the opportunity to trade with European companies, earn money and purchase the necessary equipment and resources for its work.

On September 27, 2023, the Bureau of Industry and Security of the US Department of Commerce imposed sanctions on PJSC VSMPO-Avisma Corporation.<sup>82</sup> This means that goods for export, re-export and movement within the United States, which are manufactured in the United States and intended for VSMPO-Avisma, require obtaining an appropriate license from the United States Bureau of Industry and Security. This restriction does not involve blocking the company's activities and stopping the purchase of titanium, as in the case of the US Treasury Department's SDN List, so the Russian company continues to receive profits but under control.

In February 2024, Canada imposed sanctions on the company, but later had to allow the French company Airbus to purchase titanium from the corporation due to the request of the French government, in particular Macron himself.<sup>83</sup>

Europe banned and restricted imports of Russian metals, but not titanium.<sup>84</sup> In 2019, European countries were the main destinations for Russian titanium exports, accounting for 45% of the total value of exports, according to a European Commission information note.<sup>85</sup> At the same time, Russian titanium alloys accounted for 16% of all EU titanium imports in 2019. Europe has made efforts to restructure its titanium supply chain, but the response to Canada's sanctions highlights that dependency still persists. The core issue is that the EU lacks domestic production of titanium sponge, has limited capacity for ingot production, and possesses almost no titanium processing infrastructure – while VSMPO-Avisma controls the entire production chain from raw material to finished product.

As early as October 2024, the US called on the G7 countries to impose restrictions on titanium, but as of April 2025 this had still not happened.<sup>86</sup>

However, companies related to the Russian titanium market are under various sanctions: the aforementioned PJSC VSMPO-Avisma Corporation, JSC Uralredmet, JSC Chepetsk Mechanical Plant, JSC Ruspolymet, etc. However, sanctions against these companies should cover more jurisdictions in order to completely isolate their ability to earn money and continue to feed the Russian military-industrial complex.

## ✓ RECOMMENDATIONS

- ➔ The current system of export controls governing international trade in titanium ores and products requires reform, particularly through the introduction of stricter oversight of end users. One approach could involve the use of pre-negotiated contracts that include specific clauses holding the purchasing company accountable if the products are diverted to the Russian Federation or used by Russian military-industrial enterprises. These measures should apply to both Ukrainian and foreign jurisdictions.
- ➔ The competent authorities of the EU, the United States, and other allied jurisdictions should consider imposing sanctions on individuals involved in the supply of titanium to the Russian Federation; on companies within the Russian titanium sector that support the country's military-industrial complex; and on service providers operating on their behalf. Additionally, the introduction of sector-wide, coordinated sanctions on the export and import of titanium to and from Russia should be considered, along with the freezing of assets belonging to foreign subsidiaries of Russian titanium companies. Potential targets: LLC Lovozerk MPP, Group of companies Russian Titanium Resources ("Rustitan"), LLC SGC "Arkmineral", JSC Stupinsk Metallurgical Company, JSC Chepetsk Mechanical Plant, PJSC Korporatsiya VSMPO-Avisma, JSC Uralredmet, JSC Ruspolymet and LLC Motor-invest, JSC Solikamsk Magnesium Plant, PJSC Uralkaliy, LLC KV-Titan, LLC Sibirsky Titan, group of companies "Stork", Hermith GmbH, Titan 2 İc İc İnşaat Anonim Şirketi, Ruspolymet GmbH.
- ➔ A ban on international inspection and certification bodies – such as SGS, Bureau Veritas Certification, or Nadcap PRI – from certifying products or technological processes at certain enterprises, including JSC Uralredmet, JSC Ruspolymet, and JSC Stupinsk Metallurgical Company, would deal a significant blow to these manufacturers. Such a measure would directly impact their ability to export, as certification is often a prerequisite for access to international markets.
- ➔ At the same time, Ukrainian titanium enterprises require funding for development and additional investment. Opening the market to foreign investors is essential, and the recently signed agreement establishing the U.S.-Ukraine Reconstruction Investment Fund<sup>87</sup> is a positive step in this direction. However, any potential deals must be carefully vetted, with all associated risks and the identities of ultimate beneficiaries thoroughly assessed. Additionally, companies operating in partially occupied regions of Ukraine – even those located relatively far from the front lines – are facing difficulties in selling their products. International buyers often perceive these areas as unstable and are therefore reluctant to engage in trade. It is crucial for Ukraine to raise this issue with international partners and provide targeted support to affected companies.
- ➔ States should work to reorient their markets toward new partners, particularly by identifying and pursuing cooperation with the top 10 titanium-exporting countries, as an alternative to continued reliance on the Russian Federation. At the same time, it is essential to begin developing a comprehensive titanium production chain within the European Union to reduce dependence on external sources and strengthen strategic autonomy in this critical sector.



Today, Ukraine has a unique opportunity to become a strong and reliable partner for its strategic allies and the civilized world at large. This would make Ukraine an attractive destination for genuine private investment while helping to eliminate oligarchic influence with ties to Russia in the industry. At the same time, blocking the export and import of Russian titanium would disrupt the production of certain types of Russian weapons and reduce the profits of the companies that finance the war.



The study did not cover a detailed overview of all supplies, but provides a general understanding of market trends. Further research is also needed into the supply of individual titanium products and the countries from which titanium products arrive in the Russian Federation. Potential countries that could replace Russia and its titanium products require deeper analysis by relevant specialists.

1. Auxiliary alloys used in metallurgy to introduce alloying elements into liquid metal to impart certain properties to the metal melt
2. <https://www.rsc.org/periodic-table/element/22/titanium>
3. <https://www.rsc.org/periodic-table/element/22/titanium>
4. <https://www.usgs.gov/centers/national-minerals-information-center/titanium-statistics-and-information>
5. <https://www.statista.com/statistics/759972/mine-production-titanium-minerals-worldwide-by-country/>
6. <https://dprom.online/mtindustry/rossijskij-titan-ot-legend-k-realnosti/>
7. Alloying elements are chemical elements, mainly metals, that are added to alloys to give them certain properties.
8. [https://rmis.jrc.ec.europa.eu/uploads/220616\\_Briefing\\_Titanium.pdf](https://rmis.jrc.ec.europa.eu/uploads/220616_Briefing_Titanium.pdf)
9. <https://www.statista.com/topics/11141/titanium-industry-worldwide/#topicOverview>
10. <https://www.statista.com/statistics/759972/mine-production-titanium-minerals-worldwide-by-country/>
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