VSMPO-AVISMA, STATUS AND GROWTH PERSPECTIVES

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ANNOTATION.
The report states the history of creation of two leading companies of Russian titanium industry, VSMPO and AVISMA. It covers the changes in their interaction, status and development perspectives. The report shows the brief description of the basic production areas of the corporation, approval status of quality systems, processes and products and also the justification of advantages of processes and organization of production of the corporate basis. There are the perspectives outlined with regard to the participation of the corporation on the world titanium market.
Key words: VSMPO, AVISMA, metallurgy, titanium, titanium alloys, technology, quality, certification, titanium market.

Production and technological corporation consisting of two joint-stock companies, VSMPO (Verkhnaya Salda Metallurgical Production Association) and AVISMA, 70 % shares of which belong to VSMPO, make a production base for the titanium industry in Russia. Both companies are located in Central Russia in the middle of the Urals.

Joint-stock company Avisma is one of the world's largest manufacturers of titanium sponge, magnesium and magnesium alloys. The plant was commissioned in 1943, the production of sponge titanium started in 1960. Reconstruction and growth of the plant was scheduled to provide titanium facilities at VSMPO with sponge titanium. Thus, these 2 companies were combined into one process chain to produce metallurgical semi-product from titanium alloys, although they were controlled by different administrations. Today, Avisma is the sole manufacturer of titanium sponge in Russia.

Joint-stock company VSMPO is the first and largest company manufacturing aircraft semi-finished product in Russia. The company manufactures ingot, billet, bar, plate, sheet, section and forging from titanium alloys. VSMPO was set up in 1933, the production of titanium ingot started in 1957, as a result of the reconstruction of existing facilities and building of new shops early in 70-s, VSMPO have become the largest integrated manufacturer of ingot and a wide range of mill products from titanium alloys. In those days, capacity and output of product had increased to beyond the output of all the world's titanium manufacturers together [1, 2, 3, 4].

Before 1992 50-55% of titanium was intended for commercial and military aircraft and engine production; about 10-15% - for the construction of space vehicles and rockets, shipbuilding industry (mainly for submarines) and 20 % only- for the basic branches of industry used approximately 20 %. This percentage of distribution was due to a high level of technical and technological equipment and training and qualification of personnel as well as the compliance with quality requirements.

With the development of conversion processes in Russia both companies found themselves in a very difficult situation, resulting from a sharp decline in the demand for titanium product for defense application. They had to survive separately since during the privatization process they had different owners. One of the ways for the companies to resolve the situation was to integrate with the world economy and to enter the world titanium market, which was experiencing a shortage in titanium product. By entering the world market separately, both companies were competing with each other. Late in 1998, when close corporate relations between VSMPO and Avisma were established the situation had been changed. There had been created a unique industrial and technological complex comprising a "closed-up" production cycle – from ore material to the production of practically all types of metallurgical semi-product. In our opinion, this creates good conditions for the stabilization of the Russian Titanium industry increasing the quality and reliability of product by improving the process of production and inspection of the technological route, from sponge to the finished product. This ensures a total responsibility of one supplier for quality and delivery of product. It also makes a good basis for meeting the delivery dates and conducting a more balance, consistent and competitive price policy.

In order to enter the world titanium market VSMPO and AVISMA had to guarantee a higher quality of product and also to prove consistent reproduction of product through the creation, introduction and certification of quality system, processes and product. Both companies have successfully completed that phase.

Having introduced computer controls Avisma upgraded the control system of main manufacturing processes that have resulted in stability and high quality of product. Today, Avisma is an approved supplier for all world aircraft companies except for Pratt & Whitney who is planning complete the qualification in the middle of this year*. The next stage of qualification of AVISMA for supply of titanium sponge for rotor-grade product is scheduled for commencing late in 1999.

A great amount of work on approval of quality system, production processes and product was performed at VSMPO. Over more than five years the company obtained 111 different approvals for quality management system, different types of product, manufacturing processes, testing and inspection. A majority of approvals were granted for the first time in Russia [5].

Qualification activity was not a simple activity for VSMPO and continues to be not straightforward. Considering the requirements of the western aircraft manufacturers for quality systems in general, for compliance with the international standards, finishing and inspection operations, for macro- and microstructure of product, for cleanliness and homogeneity of product, VSMPO had to make a considerable investment. It should be noted that from 1992 to 1998 the company was to invest more than 40 million US dollars of its own funds in the development of the production, inspection and testing equipment. That very time there emerged a necessity to involve the research and scientific potentials of the VSMPO experts to essentially complete a psychological and structural re-organization of the manufacturing personnel.

Quality of metal is fully dependent on quality of ingot. The preparation and inspection of charge materials, fabrication of a solid (no welding applied) compacted consumable electrode, melting performed at a optimal range of current modes and magnetic fields of the stirring coil enables to produce ingot homogeneous in structure with a low probability of inclusions occurrence. Even for Ti-10V-2Al-3Fe alloy, the most troublesome of the western alloys there was a technology developed, which enables billet and die-forging being free from unacceptable beta-flecks, if the ingot is successfully melted.

In recent years a manufacturing process for billet 100-400 mm (4"- 16") in diameter from Ti-6Al-4V and Ti-10V-2Al-3Fe alloy was upgraded as well as equipment for billet manufacture. VSMPO had procured, assembled and commissioned a hydraulic forgings press with a capacity of 6 thousand tons for the manufacture of billet in alpha+beta area with a subsequent water quenching. There has been a process mastered for the forging of billet from Ti-6Al-4V alloy on the radial-forging machine and equipment assembled for cutting and machining of billet. Also there was equipment put into operation for ultrasonic inspection of billet to the stringent requirements of aerospace specifications. It scheduled to procure and master a new machine for multi-zone inspection of billet, which will facilitate qualification of rotor-grade products.

VSMPO mastered a process of the manufacture of plate and lateral panels for pylons from Ti-6Al-4V alloy to the requirements of aerospace standards. The process comprises creep annealing, ultrasonic inspection and surface finish to the customer's requirements.

VSMPO produce sheet from Ti-6Al-4V alloy utilizing pack-rolling process, which is used for SPF. Relevant equipment has been purchased to improve the surface finish and a process improved for the pickling of sheet, which ensures a decreased content of hydrogen in sheets, which was previous an issue.

VSMPO are an approved supplier of blade bars from different alloy grades: Ti-6Al-4V, Ti-8Al-1Mo-1V, Ti-4Al-4Mo-2Sn. The product is delivered in large volumes to the leading aircraft companies (GE, PW, Snecma and RR). In 1998 the share of VSMPO in the world deliveries accounted to 7.8 %. The defect occurrence in the VSMPO metal is as half as much as the average world level. The customers appraise the high quality of our product, especially its inspectability, which is explained by the fine grain structure of bars, provided by the manufacturing process. Also, the company mastered the manufacture of ingot and bar from Ti-6Al-2Sn-4Zr-2Mo and Ti-6Al-6V-2Sn alloys as well as sheet product from Ti-6Al-2Sn-4Zr-2Mo alloy to the requirements of international aerospace specifications.

During the last two years VSMPO have mastered manufacture of tubing billet from Ti-3Al-2.5V alloy for application in hydraulic systems of aircraft. Today, this type of product is in serial production.

VSMPO possess unique capacities for manufacture of forgings. There is a wide range of forging presses at VSMPO, with a capacity of 2,4,6,20,30,75 MT (the most powerful in the world), hydraulic screw presses with a capacity 5600 and 6300 tons and 13 and 23 tons hammers.

VSMPO used to produce all types of die-forgings from titanium alloys for all types of engines and aircraft in Russia, both for critical and rotating parts. Super alloys and high-strength steel were used for the manufacture of die-forgings.

Today, Boeing, British Aerospace, Daimler-Crysler Aerospace, which were our first overseas customers carry out tests or already use production batches of die-forgings supplied by VSMPO and initial tests have not disappointed them. A progress of mastering of new part numbers is also scheduled in short-term.

* Qualification of sponge titanium of AVISMA by Pratt & Whitney has been completed in September, 1999.

Along with quality problems the problems pertaining to just-in-time deliveries are being resolved. The delivery of value-added product was fairly questioned by the customers (although alternative suppliers did also not meet delivery dates). In order to shorten the delivery time of the product to the customer VSMPO use the consignment warehouses in Europe and the USA.

So, Russian titanium is on the world market. It is on the market not for consideration of momentary advantage. There are objective reasons for that. The presence of Russian titanium on the market seems to be positive since it guarantees the saturation of the market with titanium, it also expands the sphere of its application of the progressive structural material and withholds price increase, and especially in respect of the merge of the western titanium manufacturers and the decrease of numbers of alternative sources. References to a " Russian" risk with respect to VSMPO and Avisma are not appropriate since both companies are strongly integrated with the most processable sector of the world economy. It does not matter who is at the wheel is, moreover, Centrobank of Russian Federation gave an authorization to VSMPO to set up the VSMPO affiliates in USA, Europe and Japan.

In spite of certain economic hardships in Russia VSMPO and Avisma continue their development. Today, 6 years after entering the world titanium market VSMPO cooperate, and also on the long-term basis, with more than 56 companies in USA, Europe, Japan, Korea, South America and India, and mainly, in the aerospace sector. Our strategic goal is development and expansion of cooperation established with worldwide partners.

SUMMARY

1. Creation of the technological corporation comprising two joint-stock companies AVISMA-VSMPO has considerably strengthened the position of titanium industry of Russian Federation on the world titanium market, ensuring the single technical, organizational and commercial policy throughout the whole manufacturing cycle – from ore to the finished metallurgical product.
2. The corporation AVISMA-VSMPO has done a tremendous job to ensure and increase the product quality by improving the manufacturing processes and testing practices, updating of process, testing and inspection equipment.
3. Quality system, processes of manufacture, testing and inspection, product fabricated by the corporation were positively recognized and approved by the most aerospace companies in the world.
4. AVISMA and VSMPO actively participating on the world titanium market, which makes a positive influence on the price level and expands the spheres of titanium application.

REFERENCES:

1. V.V.TETYUKHIN: "VSMPO today". *Titan*, 1996, No 1 (9), p.3-4.
2. A.I.GRISCHETCHKIN: "Main tendencies of the reconstruction and development of VSMPO titanium production". *Titan*, 1996, 1(9), p.5-7.
3. I.L.TEYTEL, V.K.ALEXANDROV, A.O.EZHOV: "Mastering of titanium production at VSMPO". *Titan*, 1996, No 1(9), p.15-17.
4. A.N.STROSHKOV: "VSMPO today". *Technology of light alloys*, 1999, No 1-2, p.50-56.
5. A.N.STROSHKOV: "Experience of the association for the certification of materials for aerospace industry". *Aviation industry*, 1999, No 2, p.60-63.