Research Group

InfoMine

Association of independent consultants and experts
in the field of mineral resources, metallurgy and chemical industry

Aluminium Alloy Sections Market Research in Russia

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Annotation

The report is devoted to research of current standing of market of aluminium alloy sections in Russia and forecast of its development. The report consists of 7 parts, contains 158 pages, including 21 Figures, 51 Tables and 2 Appendixes.

The first part presents brief characteristics of current standing of world market of aluminium alloy sections.

The second part is devoted to studying available resources for production of aluminium sections (in fact, in case of description of aluminium sections, actually sections from various aluminium alloys are meant, as will be described below). The part includes nomenclature and statistics on primary aluminium, aluminium alloys and round ingots (aluminium columns), produced in Russia. The main suppliers of resources for extrusion productions are described, and data on directions and volumes of supplies of the main kinds of resources to the producers are given.

In the third part, requirements, imposed on grade of building sections and section for walling from aluminium, being in force in current Russia, are presented.

In the fourth part, Russian domestic production of the sections is described. Statistics of production of aluminium alloy sections in Russia in 2000-2007 is given, and regional structure of the production has been evaluated. Besides, in the part, description in details and analysis of productive activity of 10 leading companies, producing the sections, including data on productive capacities, volumes of production for the latest 8 years, commodity pattern of the production produced; in addition, plans on creation of new extrusion productions in Russia are given.

The fifth part is devoted to analysis of foreign trade operations in aluminium alloy sections in 2000-2007. Data on dynamics of export-import operations, regional structure of the supplies, the main exporters and importers of the sections are presented. Besides, in the part, analysis of dynamics of average export and import prices on the sections is given.

In the sixth part of the report, supply-demand balance of aluminium alloys in Russia is presented, as well as estimation of regional and sectoral pattern of consumption of the products and description of large consumers (processors) of architectural system sections is given.

The last, seventh part of the report is devoted to forecast of aluminium alloy sections consumption in Russia in 2008-2012. Current tendencies are described, estimation of current standing and prospects of development of end-uses is given, and forecast of aluminium alloy sections production and consumption up to 2012 is presented.

In the Appendixes, contact information on the main producers and processors of aluminium sections is presented.

Introduction

Aluminium, owing to its properties and development of technologies of mechanical, thermic and chemical treatment finds growing application in various fields, first of all, in building sector. Aluminium systems provide practically unlimited possibilities for architectural forming houses and constructions. Besides, use of the metal in architecture and building is profitable from exploitation, corrosion-resistance and possibilities of secondary treatment viewpoints. Wide application of aluminium is owed by its high strength and long service life. These all characteristics owe prospects of aluminium constructions application in building and machine building sectors.

At present time, market of aluminium sections is one of the most actively developing in Russia. In spite of launching a number of new productions of sections in latest years in the country, the market is undersaturated as yet, especially for high-grade architectural and walling sections. Profitability of the market attracts new producers in the sector. In this connection, strengthening competition in the market is obvious.

1. Brief review of world market of aluminium alloy sections

From data of *International Aluminium Institute (IAI)*, world production of primary aluminium in 2007 increased by 3.91% compared with 2006 to 24.8 mln t.

According to data of IAI, in 2007 North America increased production of primary aluminium by 5.81% – to 5,64 mln t, Western Europe - by 2.96%, to 4.31 mln t, Eastern and Central Europe (including Russia) increased production of the product by 5.44% – to 4.46 mln t. Asian countries production of aluminium by 6.13% – to 3.71 mln t, Latin America – by 2.57% to 2.56 mln t. In Africa, production aluminium decreased compared with 2006 by 2.63% – to 1.81 mln t. The production in countries of Oceania increased by 1.8%, to 2.31 mln t.

According to data of *World Bureau of Metal Statistics (WBMS)* in 2007 world market of primary aluminium demonstrated overproduction of the metal by 499 kt. World consumption of primary aluminium in 2007 was 37.52 mln t, by 3.184 mln t (or by 9.3%) more than in 2006. World production of primary aluminium increased in 2007 by 4.024 mln t compared with 2006 and reached 38.02 mln t.

World production of aluminium semis increased in 2007 by 44% compared with 2006 that approximately corresponds to increasing apparent consumption of primary aluminium in China. Production of primary aluminium in EU countries (EU 27) remained practically at 2006 level, that in NAFTA countries increased by 5.6%. Consumption of aluminium in EU countries increased in 2007 by 4.0% compared with previous year.

From data of company *Hydro*, in 2007 world consumption of aluminium products reached 50.4 mln t, and the bulk of the consumption of belonged to China (27% of world consumption), North America and Mexico (22%), and Western Europe (19%).

From data of *European Aluminium Association (EAA)*, at present time, building industry is the second greatest end-use of aluminium (27%), being inferior of transport sector only (36%). Experts estimate world consumption of aluminium in building industry reaches 6.7-7.0 mln t, and demand for aluminium articles increases at a rate of 4-5% per year.

From data of *EAA*, there are above 300 extrusion productions in EU countries, and production volume of aluminium alloy sections in 2007 in West-European countries increased by 3% compared with previous year and reached 3.4 mln t. Volume of the consumption was 3.48 mln t, and difference between imports and exports of aluminium sections in 2007 reached 80 kt and demonstrates uptrend.

Consumption of extruded articles in building in EU countries forms around 50% of total demand for the sections from all end-uses. In total demand for aluminium articles in building sector, around 605 belong to extruded sections, and residual 40% to flat-rolled aluminium (siding, ventilation channels, sound-insulating shields, tents, etc.) and cast pieces.

Consumption of extruded sections in USA in 2007 decreased by 15% compared with 2006 and to around 1.45 mln t only that was owed by considerable setback in building industry in connection with mortgage crisis and overall economic depression in the country.

One of the main tendencies of European market of extruded sections is expanding range of aluminium alloys, used in building. In mid-20th century, when active introducing of aluminium in building began, the great bulk of constructions was manufactured with the use of extruded sections from alloy 6063 of system Al-Mg-Si, patented in 1954 in USA (analogue of AD31). Then development of building alloys was connected with improving their mechanical properties at the expense of growing alloying with Mg and Si (alloy 6061 – analogue of AD33), adding manganese, chrome (for increasing strength and neutralizing negative impact of iron impurities) and Cu (to stabilize properties). Increasing content of Si promoted increasing strength without marked decreasing moulding ability (examples - alloys 6082 (AD35)).

Later strict competition with PVC and coated steel in building sector forced producers of aluminium sections to use more complicated shapes, decreased wall thickness and improved surface finishing that, in turn, required higher-alloyed alloys of improved extrudability, such as alloy 6060.

At present time, there are around 70 grades of Al-Mg-Si alloys in the world. They are subdivided into building alloys for walling (close in composition to alloys 6060, 6063 and having strength in T5 state of 170-250 MPa, and structural alloys of medium strength, used for supporting structures, of type 6061, 6082 with higher content of alloying elements and strength limit in T5 state of at least 300 MPa.

Development of building bridges with aluminium constructions, aluminium cupola for oil storages, long span structures for roofing sport halls, stadiums, exhibition and trading centers required higher-strength weldable systems Al-Mg-Mn and Al-Zn-Mg, as well as alloys of duraluminum type (2024, D16) and other.

General tendency for all building alloys is strict limits of chemistry (within grades), more strict alloying limits, imposed by firm-producers of ingots and semis to meet specified requirements, imposed on finished products. Besides, content of element-impurities (not-alloying) is also regulated more strictly.

The great bulk of building constructions from aluminium alloys has protective-decorative cover, most often, powdery-painting. At European market, relation between painted and anodized products estimates by EAA of 1.8:1.

One more characteristics of aluminium alloy sections is decreasing metal consumption in element of building constructions. Modern extrusion sections used in manufacture of transparent constructions and facades, have minimal thickness of elements of 0.4-0.6 mm and permissible deviation of flange thickness of 0.1 mm. Leader at European market of façade, window, door and winter garden systems from such sections is German company Schueco International, supplying the section systems and components to above 60 countries. Decreasing metal consumption is owed by the following:

- applying new-generation extruders with increased rigidity – compact horizontal extruders with front feeding (feeding semis between container and matrix block that provides improved preciseness of finished extruded sections;

- optimizing chemistry of alloys by regulating amount and morphology of iron-containing phases and phase Mg_2Si, as well as grain structure in extruded semis;

- optimizing temperature-speed regimes of extrusion, for instance, applying isothermic extrusion.

Active increasing demand for aluminium on the background of overall growth of world economy, USD devaluation and increasing prices on power resources resulted in considerable increasing prices on aluminium and products of its processing. From expert's estimates, the situation will remain in force in world economy in nearest years that will result in further growth of prices on aluminium. Thus, in spite of positive forecasts of development of European market of building aluminium constructions, experts forecast considerable strengthening competition with alternative structural materials (first of all, PVC form transparent constructions and steel sections for facades).

According to forecasts of CRU, in 2008 extruded products output in EU will remain at 2007 level. Slight decreasing production and consumption of building sections, owed by decreasing volumes of building in Southern Europe and Germany, will be compensated by growing consumption of extruded sections in transport machine building.

In USA, in medium-term prospects, further decreasing consumption of extruded aluminium sections is expected, whereas in South America, for instance, in Brazil and Argentina, increasing consumption of the products at a rate of around 7% per year is forecasted.

2. Resources for production of aluminium alloy sections

2.1. Range of products and statistics of production

As resources for production of sections, technical aluminium and deformable aluminium alloys, obtained by melting of primary aluminium or aluminium scrap with alloying additives, are used.

Primary aluminium

Depending on content of impurities, the following types of primary aluminium (GOST-11069), designated for production of pigs, ingots, wirerod, etc., are distinguished. Grades of primary aluminium and its chemical composition are presented in Table 1.

Table 1. Grades of primary aluminium and its chemical composition

Grade	*Content, maximum %*						
	Al, minimum	*Fe*	*Si*	*Cu*	*Zn*	*Ti*	*Other impurities, total*
A999	99.999	-	-	-	-	-	0.001
A995	99.995	0.0015	0.0015	0.001	0.001	0.001	0.005
A99	99.99	0.003	0.003	0.003	0.003	0.002	0.01
A97	99.97	0.015	0.015	0.005	0.003	0.002	0.03
A95	99.95	0.03	0.03	0.015	0.015	0.002	0.05
A85	99.85	0.08	0.06	0.01	0.02	0.008	0.15
A8	99.8	0.12	0.1	0.01	0.04	0.01	0.2
A7	99.7	0.16	0.15	0.01	0.04	0.01	0.3
A7E	99.7	0.2	0.08	0.01	0.04	0.01	0.3
A6	99.6	0.25	0.18	0.01	0.06	0.02	0.4
A5E	99.5	0.35	0.12	0.02	0.04	0.015	0.5
A5	99.5	0.3	0.25	0.02	0.06	0.02	0.5
A0	99	0.5	0.5	0.02	0.08	0.02	1

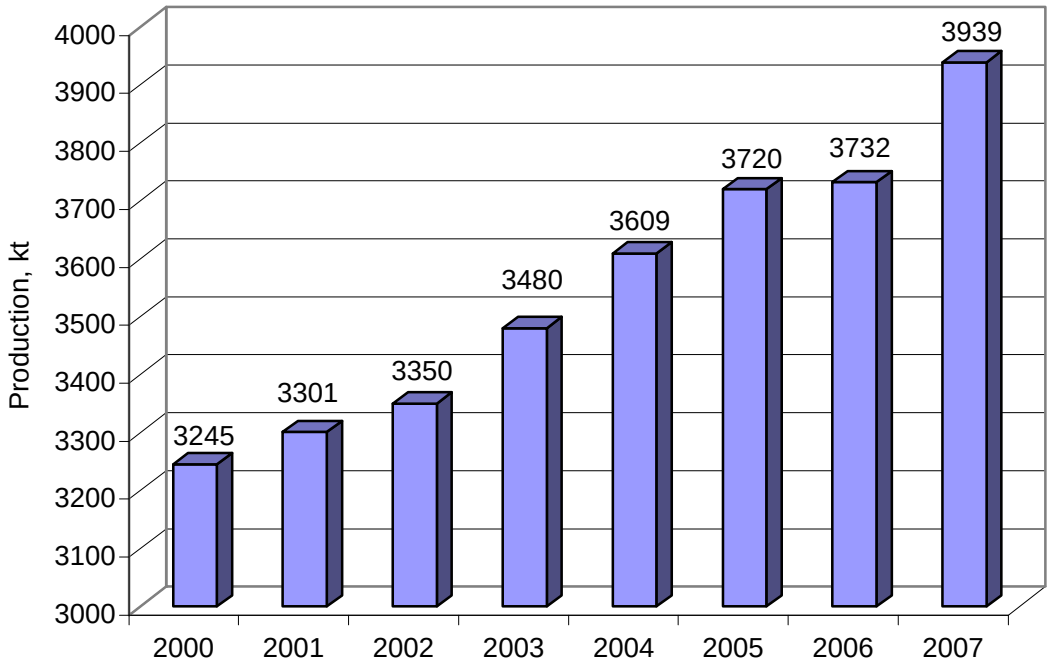
Source: FGUP "Standartinform"

In addition to primary aluminium, also technical aluminium has been standardized (alloys AD00, AD0, AD1, AD), produced in form of deformable semiproduct (sheet, sections, rods, wire, etc.)/

As such, aluminium is characterized by low mechanical strength, which, however, can be raised by adding alloying components for production of aluminium alloys.

At Fig. 1, dynamics of production of primary aluminium in Russia in 2000-2007 is shown.

Figure 1. Dynamics of production of primary aluminium in Russia in 2000-2007, kt



Source: NP"Aluminium", data of "InfoMine"

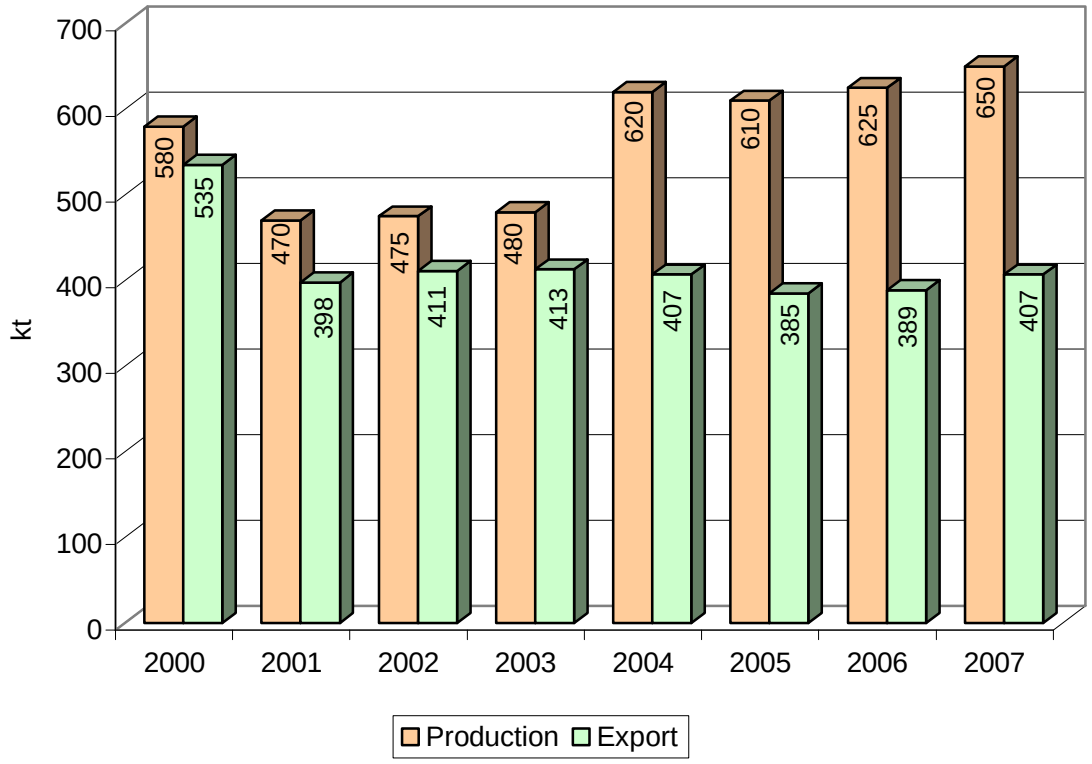
Secondary aluminium

According to estimates of experts of "InfoMine", share of secondary aluminium alloys, used for production of sections, is currently maximum 15-20% of total resources used, but in latest years the share demonstrates uptrend.

In latest years, production of secondary aluminium alloys in Russia exceeds 600 kt annually and also demonstrates uptrend. From data of Minpromenergo, in Russia in 2007, around 440 officially-registered producers of secondary aluminium alloys were available, but actually production of the products was realized by 165 enterprises only. Above 60% of secondary aluminium alloys production volume belong to 12 greatest producers.

Notice that the bulk of secondary aluminium, produced in Russia is exported. Dynamics of production and export of secondary aluminium alloys in Russia in 2000-2007 is presented in Figure 2.

Figure 2. Dynamics of production and export of secondary aluminium alloys in Russia in 2000-2007, kt



Source: Federal Customs Service of Russia, data of "InfoMine"

Deformable aluminium alloys

For production of rolled aluminium, deformable aluminium alloys are used, grades and chemical composition of which (according to GOST 4784-97) are presented in Table 2.

Table 2. The main grades of deformable aluminium alloys, their chemical composition

Label	*Label in figures (digital)*	*Content, %*							
		Cu	*Mg*	*Mn*	*Zn*	*Fe*	*Si*	*Ti*	*other*
AD00	1010	0.015	0.02	0.02	0.07	0.16	0.16	0.05	-
AD0	1011	0.02	0.03	0.025	0.07	0.3	0.3	0.1	-
AD1	1013	0.05	0.05	0.025	0.1	0.3	0.3	0.15	-
AD	1015	0.1	0.1	0.1	0.1	0.5	0.5	0.15	-
MM	1403	0.02	0.2-0.5	1-1.4	0.1	0.6	1	0.1	-
AMN	1400	0.1	0.2	1-1.6	0.1	0.7	0.6	0.2	-
D12	1521	0.1	0.8-1.3	1-1.5	0.1	0.7	0.7	0.1	-
AMg1	1510	0.1	0.7-1.6	0.2	-	0.1	0.1	-	-
AMg2	1520	0.1	1.8-2.6	0.2-0.6	0.2	0.4	0.4	0.1	-
AMg3	1530	0.1	3.2-3.8	0.3-0.6	0.2	0.5	0.5-0.8	0.1	-

Label	***Label in figures (digital)***	***Content, %***							
		Cu	***Mg***	***Mn***	***Zn***	***Fe***	***Si***	***Ti***	***other***
AMg5	1550	0.1	4.8-5.8	0.3-0.8	0.2	0.5	0.5	0.1	Cr 0.05
AMg5P	1551	0.2	4.7-5.7	0.2-0.6	-	0.4	0.4	-	-
AMg6	1560	0.1	5.8-6.8	0.5-0.8	0.2	0.4	0.4	0.1	-
AD31	1310	0.1	0.4-0.9	0.1	0.2	0.5	0.3-0.7	0.15	-
AD33	1330	0.2-0.4	0.8-1.2	0.15	0.25	0.7	0.4-0.8	0.15	Cr 0.35
AD35	1350	0.1	0.8-1.4	0.5-0.9	0.2	0.5	0.8-1.2	0.15	-
AV	1340	0.1-0.5	0.5-0.9	0.1-0.3	0.2	0.5	0.5-1.2	0.15	Cr 0.25
D1	1110	3.8-4.8	0.4-0.8	0.4-0.8	0.3	0.7	0.7	0.1	Ni 0.1
D1P	1111	3.8-4.5	0.4-0.8	0.4-0.8	0.1	0.5	0.5	0.1	-
D16	1160	3.8-4.9	1.2-1.8	0.3-0.9	0.3	0.5	0.5	0.1	Ni 0.1
D16P	1161	3.8-4.5	1.2-1.6	0.3-0.7	0.1	0.5	0.5	0.1	-
V65	1165	3.8-4.5	0.1-0.3	0.3-0.5	0.1	0.2	0.25	0.1	-
D18	1180	2.2-3	0.2-0.5	0.2	0.1	0.5	0.5	0.1	-
AK4	1140	1.9-2.5	1.4-1.8	0.2	0.3	0.8-1.3	0.5-1.2	0.1	Ni 0.8-1.3
AK4-1	1141	1.9-2.7	1.2-1.8	0.2	0.3	0.8-1.4	0.35	0.1	Ni 0.8-1.4
AK6	1360	1.8-2.6	0.4-0.8	0.4-0.8	0.3	0.7	0.7-1.2	0.1	Ni 0.1
AK8	1380	3.9-4.8	0.4-0.8	0.4-1.0	0.3	0.7	0.6-1.2	0.1	Ni 0.1
-	1915	0.1	1.3-1.8	0.2-0.6	3.4-4	0.4	0.3	0.1	Cr 0.08-0.2. Zr 0.15-0.22
-	1925	0.8	1.3-1.8	0.2-0.7	3.4-4	0.7	0.7	0.1	Cr 0.2. Zr 0.2
V95	1950	1.4-2	1.8-2.8	0.2-0.6	5.0-7.0	0.5	0.5	-	Ni 0.1. Cr 0.1-0.2
V95P	1957	1.4-2	2-2.6	0.3-0.5	5-6.5	0.3	0.3	-	-

Source: FGUP "Standartinform"

Alloys of aluminium with manganese and magnesium refer to deformable aluminium alloys, non-strengthened by thermic treatment.

Alloys of aluminium with manganese (first of all, AMts) differ from technical aluminium by higher strength, keeping, at the same time, high pliability and good weldability. Alloys of aluminium with magnesium (grades AMg1, AMg2, AMg3, AMg5, AMg5P, AMg6 and other), named magnaliumium, combine satisfactory strength with high pliability and corrosion resistance.

Magnaliumium is widely used in building (window and door constructions), in ship building (ship welded bodies, etc.), in railway transport (good vans, refrigerator cars (inner edge walls), tanks for nitric acid, etc.), in rocket and aircraft building (reservoirs for fuel, tubes, welded cans and other parts of welded constructions of rockets and aircrafts).

Alloys of normal strength, forge (forgable) alloys, alloys of increased pliability, high-strength aluminium alloys, weldable alloys, heat-resistant alloys refer to a Group of deformable aluminium alloys. The above-listed groups of deformable aluminium alloys has own letter classification, which is presented in Table 3.

Table 3. Groups of aluminium deformable alloys

Groups of alloys	***Characteristics***	***Composition***	***The most widespread grades***
1xxx	Primary and technical aluminium	Al	A5, A5E, A7, A7E, AD0, AD1, AD
2xxx	Alloys of normal strength and forgable alloys	Al-Cu-Mg and Al-Cu-Mg-Si	D1, D16; AK6, AK8
3xxx	Alloys of aluminium with manganese	Al-Mn	AMts, MM, AMtsR, AMtsS
5xxx	Alloys of aluminium with magnesium	Al-Mg	AMg1, AMg2, AMg3, AMg5, AMg6
6xxx	Alloys of increased pliability	Al-Mg-Si	AD31, AD33
7xxx	High-strength and weldable aluminium alloys	Al-Zn-Mg-Cu	V95, V95P, 1915,1925
8xxx	Heat-resistant alloys	Al-Cu-Mg-Ni-Fe	AK4, AK4-1

Source: FGUP "Standartinform"

Alloys of normal strength - duralumins – are the most widespread aluminium alloys. Besides common duralumin of grade D1, alloys of increased strength (D16), increased pliability (D18, V65) are produced. Alloy D1P is designated for manufacturing wire. In aircraft building, alloy D1 is used for manufacturing propeller vanes, alloy D16 - for manufacturing of fuselage and wings. Alloy D19 is used for manufacturing constructions of crucial importance, subjected to heating. Alloys D16 and D18 are used as rivet. In oil production, alloy D16 is applied in manufacturing drilling pipes.

Forgable aluminium alloys (AK6, AK8) differ from duralumin by increased silicon content and high pliability in hot state. Alloy AK6 is applied in machine building for manufacturing common importance forged pieces – parts of automobile motor. Alloy AK8 is used for manufacturing forged pieces of crucial importance – parts of aircrafts (fittings, framework parts, etc.).

Alloys of increased pliability (AV, AD31, AD33, AD35) are less alloyed compared with duralumins, less strong but more pliable that allow to subject them to stamping (extruding, forging), drawing, to manufacture articles of complicated shape, including vugh sections. Alloy AD33 is applied in aircraft building for manufacturing helicopter vanes, longerons, as well as in ship building and building industry. Alloy AD31 found wide application in production of extruded sections of various designation, including for walling. Besides, the alloy is used in electric in-

dustry for manufacturing current conductors and wires, in machine building for production of platforms, body parts, etc.

High-strength aluminium alloys (V95, V95P and other), compared with duralumins, are characterized by higher strength but slightly lower pliability. The alloys are used for manufacturing parts and constructions of crucial importance (high-loaded): carrying constructions of flying vehicles, rivets, etc.

Weldable aluminium alloys (1915, 1925) demonstrate rather high strength at very low temperatures, are high pliable in hot state and rather corrosion-resistant. The alloys are better in strength and workability than weldable aluminium-magnesium alloys. The weldable aluminium alloys find application in manufacturing extruded sections and pipes, used in building, automobile and railway car productions. Of alloy 1915, radiators, frames of railway cars, motor trailer tanks and other articles are manufactured.

Heat-resistant alloys (AK4, AK4-1) are close to duralumins, but, owing to alloying with iron and nickel, keep mechanical properties at elevated temperatures (their disadvantage is low corrosion resistance). AK4-1 alloy differs by lower silicon content and is more workable than AK4 alloy. The alloys are used for manufacturing parts and welded articles, working at elevated temperatures (up to 300^{o} C). Alloy AK4-1 is applied as forgable material for manufacturing part of jet engines of aircrafts, and as structural material for supersonic aircrafts and rockets.