

Olga K. Makowieckaja

Present Situation and Developmental Trends in the Global Market of Major Structural Materials and Welding Technique

Abstract: The article presents the primary indicators reflecting the state of the global market of the most important structural materials and of welding technique in 2011-2014. The assessments performed by analytical companies and major producers of welding machines and materials were used to forecast the development of this market in the years to come.

Keywords: market of structural materials, welding market, developmental trends;

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Market of Primary Structural Materials

The year 2013 saw the beginning of global stability and economic growth. The highest business activity indicators were observed in the USA and the European Union. China's economy is undergoing a transformation consisting in moving away from an export-oriented model towards an economic growth based on internal consumption. The global economy increase translates to a greater demand for structural materials used in industrial production, i.e. steels, non-ferrous metals, non-metallic materials (plastics, ceramic materials, glass etc.) and composites. The consumption of structural materials is growing steadily. In the past 5 years, the production of structural materials most commonly used in the production of welded structures has increased by 22% as regards steel, plastics and composites, by 24% in terms of aluminium and 27% as far as titanium is concerned.

In 2013, the size of the global market of plastics utilised in the production of structures

amounted to 299 million tons or 70 billion USD. It is expected that by 2020 the value of the structural materials market will have reached 90 billion USD [1]. Half of the global production and consumption of thermoplastics falls to the EU and USA. Thermoplastics are increasingly used in the automotive, industrial building, aviation, space, and machine-building industries, as well as in the power engineering sector, including wind power engineering [2, 3].

Also, non-ferrous metals are becoming increasingly common in industrial production. In 2013, the global production volume of raw aluminium amounted to 49.7 million tons, having grown by 6% in comparison with 2012. In 2014, this production increased by a further 4.8% to 53.1 million tons. It is anticipated that by 2017 the production volume of raw aluminium will have exceeded 62 million tons. The major aluminium consuming sectors are the automotive and building engineering industries with their total share in the global raw aluminium consumption exceeding 50%. In developed countries, i.e.

K.e.n. Olga K. Makowieckaja – E. O. Paton Electric Welding Institute, the National Academy of Sciences of Ukraine, Kiev

the USA, Japan and the countries of Western Europe, industries domineering in aluminium consumption are the automotive industry (Japan – 43%, USA and Western Europe – 35%) and the machine-building industry (Western Europe and Japan – 19%, USA – 15%) [4].

Figure 1 presents data concerning the production volume of primary structural materials in 1970, 2008 and 2013.

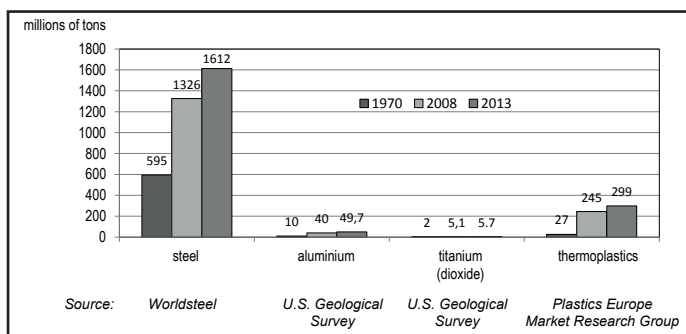


Fig. 1. Global production of primary structural materials in 1970, 2008 and 2013

The position of titanium as a key material in the space and aviation industries guarantees its further increase in consumption. In 2010-2011 China again saw a steady increase in demand for the industrial grade of titanium. The leaders of aviation, i.e. the Airbus and Boeing concerns, returned to construction programmes focused on the A380, B787 and A350 aircraft, causing a significant rise in the demand for cosmic titanium. In comparison with 2009, the global titanium market grew by approximately 60%. In 2013, the global production of titanium sponge amounted 222 thousand tons [5].

Regardless of a significant increase in the consumption of non-ferrous metals, non-metallic and composite materials, steel remains the unquestionable leader on the structural materials market. The volume of steel production is 4 times greater than the total production volume of the remaining structural materials [6].

According to data provided by the World Steel Association (WSA), in 2014, if compared with 2013, the global production of steel grew by 1.2%, amounting to 1,662 million tons. In 2014, the highest annual steel production increase

was observed in the countries of the Middle East, amounting to 7.7%. The analogous 2014 growth indicator for EU countries amounted to 1.7%, the USA – 1.7%, China – 0.9% and other Asian countries – 1.4%.

In 2014, the annual steel production in Asia amounted to 1,132.3 million tons; in China – 822.7 million tons. The share of China in the global production of steel decreased slightly from 49.7% in 2013 to 49.5% in 2014. In 2014, Japan produced 110.7 million tons of steel, South Korea – 71 million tons and India – 83.2 million tons.

In 2014, the countries of the European Union increased steel production by 1.7% to 169.2 million tons. If compared with 2013, the production of steel in Germany grew by 0.7% to 42.9 million tons, whereas in France by 2.9% to 16.1 million tons. If compared with 2013, in 2014 the production of steel in the USA increased by 1.7% to 8.3 million tons [7]. The limitation of steelmaking production capacity is still observed in the countries of Western Europe, the USA and Japan. In turn, steelmaking production capacity continues to grow in Asia (China, India) and in the Middle East. Figure 2 presents data demonstrating changes in the regional division of the global structure of steel production in 2005 and 2015.

Changes taking place in the division of steelmaking production capacity are visible in the structure of regional steel production (Fig. 3). According to data provided by the Organization for Economic Co-operation and Development (OECD), in the structure of steel production, the share of North America and the European Union decreased from 10% (USA) and 16% (UE) in 2007 to 8% and 10% in 2013 respectively. In turn, the share of Asian countries increased from 56% in 2007 to 67% in 2013. In 2013, the global consumption of steel exceeded 1.5 billion tons. Experts of the World Steel Association estimate that in 2014, the global consumption of steel increased by 1.5-2.0% to 1,562 billion tons and expect that in 2015 steel consumption will grow by a further 2% to 1,594 billion tons [7].

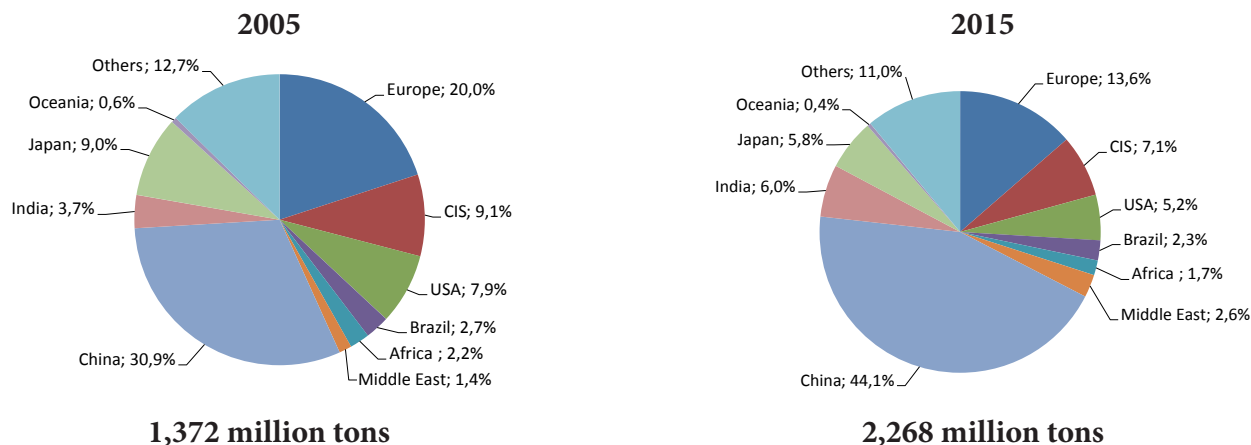


Fig. 2. Division of steel production according to regions in 2005 and forecast production structure in 2015

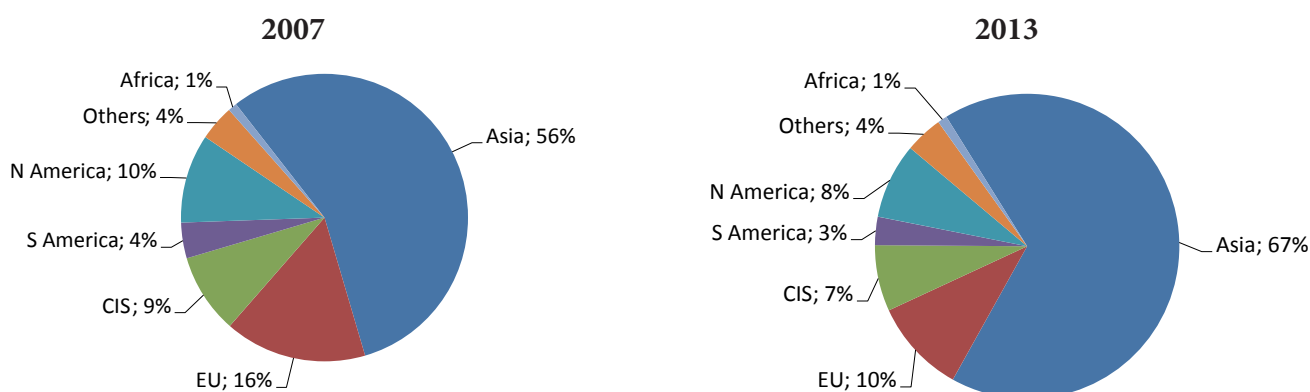


Fig. 3. Global steel production divided according to regions in 2007 and 2013

More than 2/3 of steel produced is processed using joining techniques, primarily welding. The size and structure of the welding technique market results from the volume and structure of steel consumption divided into types of production, industrial sectors and geographical regions. The effect of changes in steel consumption on sales of welding materials can be demonstrated using exemplary data connected with the consumption of steel and welding material in Japan, one of the leaders in the production of steel and welding materials (Fig. 4) [7, 8].

The major users of steel (2011) in industrial production included the industries of building engineering (60% of the total consumption), machine-building (17%) and transport, including pipeline constructions, (19%). According to forecasts, in 2025 the major steel consumers will include building engineering (68% of the global consumption), machine-building industry (13%) and the construction of pipelines (9%). In total, the industries mentioned above will consume 90% of the global steel production.

Figure 5 presents data concerning the consumption of steel in major production industries in 2011 and the forecast for 2025 [6, 7].

Building engineering is important both for global and regional economies. In 2011 the global steel consumption in building engineering amounted to 845 million tons – 60% of the total global steel consumption. It is expected that in 2025 the consumption of steel in the building sector will make up 64% of total global steel consumption, reaching 1,506 million tons. In the global structure of added value generated in building engineering, the share of countries

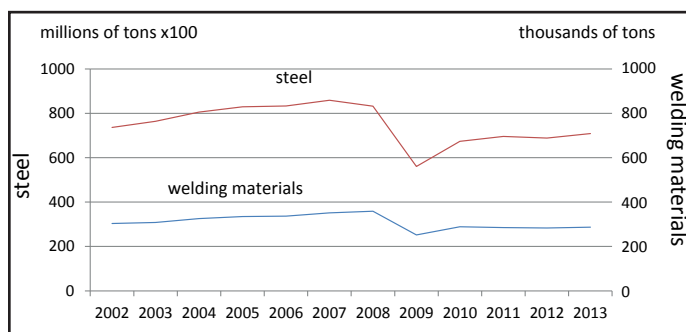


Fig. 4. Changes in the consumption of steel and welding materials in Japan in 2002-2013

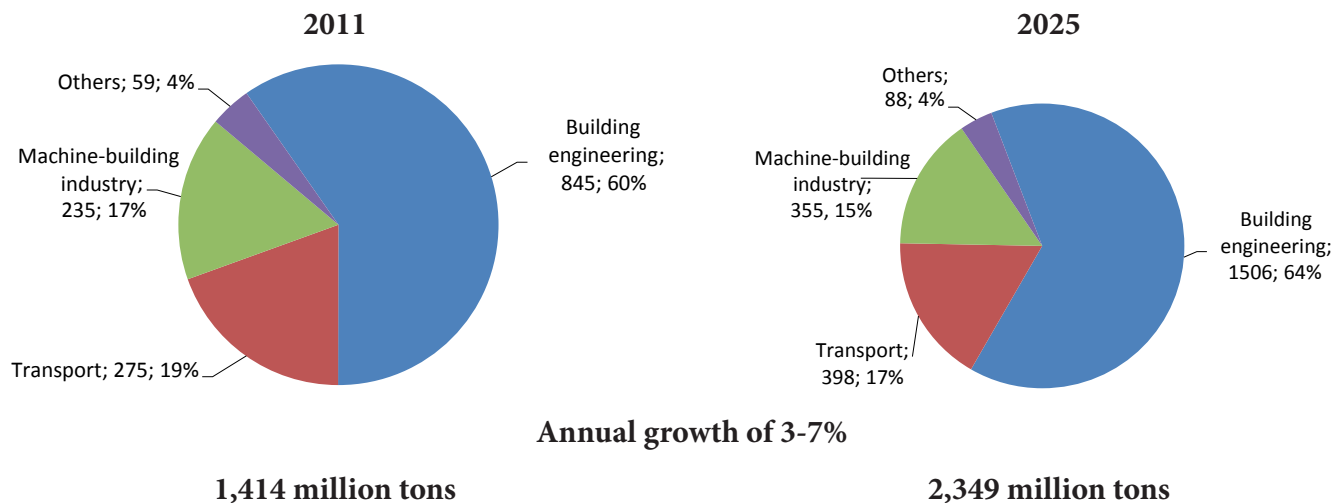


Fig. 5. Structure of global steel consumption divided into industries in 2011 and in 2025 (forecast)

from North America will reach 18.3%, European Union – 10.8%, Japan – 6.2% and China – 24%. The annual increase in added value generated in the building engineering of China will amount to 5.9%, and of India – 8.1% [6, 7].

The global steel consumption in power engineering amounted to approximately 31 million tons. According to Metal Bulletin Research, until 2025 this indicator will not change but the structure of steel consumption will see changes related to individual sectors. It is expected that the consumption of steel by the coal mining sector will decrease from 17 million tons to 16 million tons, and the steel consumption share will drop from 56% to 51%. In turn, it is predicted that steel consumption will grow by 3% in the water power engineering sector. By 2025, the consumption of steel in this sector will have reached 4 million tons. Figure 6 presents

data concerning the global steel consumption in the power engineering sector in 2011 and the forecast of consumption in 2025 [6, 7].

In 2011, the share of transport-related machine-building sector in global steel consumption amounted to 19%, i.e. 275 million tons. It is expected that until 2025 this sector will see an annual increase in steel consumption of 2.7%, yet the share of steel consumption in the transport sector will fall to 17% with consumption growing to 398 million tons. The major steel consumers in the transport sector include pipeline constructions and the automotive manufacturing. Their common share makes up 3/4 of the total steel consumption in the sector. Figure 7 presents the global steel consumption structure in the transport sector in 2011 and the forecast consumption in 2025 [6, 7].

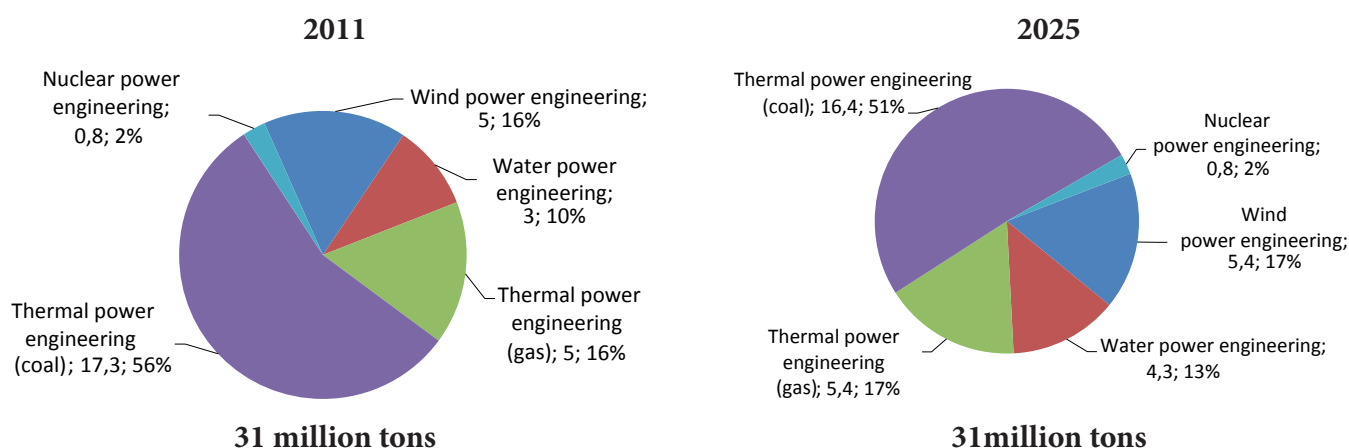


Fig. 6. Global steel consumption in power engineering sector in 2011 and forecast for 2025 (steel consumption – million tons; share – %)

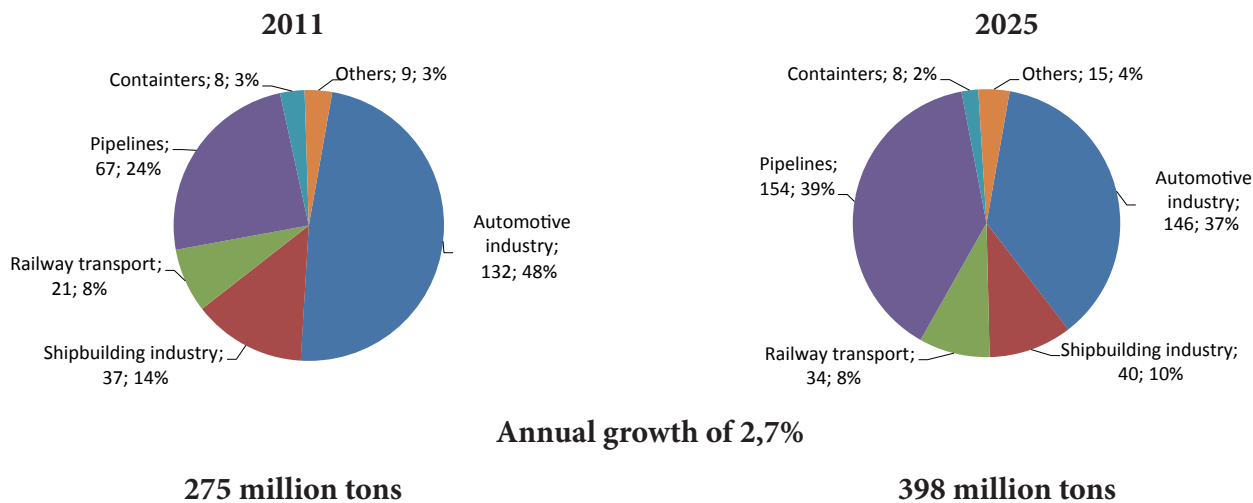


Fig. 7. Global consumption of steel in transport sector in 2011 and forecast for 2025 (steel consumption in millions of tons, share – %)

Steel is the bedrock and driving force of the global economy. In the long-term perspective the consumption of steel will grow, particularly in developing countries, where growing industrial production sectors characterised by high absorptiveness of metals and the urban development rate is significantly higher in developed countries, which translated to higher steel consumption. The increased consumption of steel as one of the major structural materials is also the consequence of increasingly extensive use of effective power-saving and environmentally friendly technologies (impossible to implement using dated equipment) in industries and urban building engineering.

Global Welding Technique Market

The global market of techniques dedicated to joining and processing materials, commonly referred to as the welding technique market, continues to grow. This fact is confirmed in annual analytical reports presented by multinational concerns and market leaders in welding technique production such as Lincoln Electric, Colfax (ESAB, Victor Technologies Group), ITW (Illinois Tool Works) etc., as well as in materials published by leading analytical companies, e.g. BBC Research, Transparency Market Research, Frost & Sullivan.

The welding technique market is characterised by significant diversification. Its actual and

valuable assessment depends on the terminology of products and services used in various analytical studies. According to most analytical institutions, welding market products include filler metals, equipment, gases used for welding and cutting, personal protective equipment, environmental protection equipment and welding accessories. Companies dealing with welding technique production analyse the size of the global welding market primarily on the basis of product-related terminology. For instance, in their market analysis ESAB includes means of automation, computerisation and robotisation into welding equipment terminology, and, as separate items, special filler metals for welding special steel and alloy grades, aluminium etc. into the terminology of welding materials. Another important aspect, as regards the evaluation of the global welding technique market, is the assessment of the markets of welding technique end users and of regional markets. For this reason, the final assessment of the welding technique market is largely affected by and should take into consideration all economic and statistical indicators. This explains the diversification of the importance of indicators used for global welding technique market size assessment performed by various companies. The data presented below result from the current state analysis and from the forecast development of welding technique published in

analytical reports of the worldwide leaders including welding technique producers and analytical institutions specialising in welding market analysis. Presently, it is possible to observe an ongoing process of welding technique market globalisation – concentration of capital (mergers and takeovers), movement of capital and labour force on a global scale, standardisation of technological processes etc. Capital and production capacity are increasingly often shifted to Asia, South America and the Middle East. Almost half of the global welding technique market is controlled by seven international concerns. For decades the unquestionable leaders of the welding technique market have been Lincoln Electric (14% of market share), ESAB (13%) and ITW (8%). The total sales values of these three concerns, in terms of production/services sold, exceed 30% of the global welding technique market.

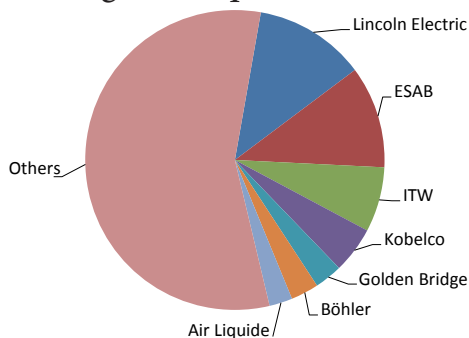


Fig. 8. Major producers in the global welding technique market in 2014

According to assessments provided by leading analytical institutions, in 2013 the value of the welding technique market was between 17 and 24 billion USD. A forecast by BCC Research predicts the welding technique market value to exceed 25 billion USD in 2019. In turn, according to Transparency Market Research the value of the welding technique market will reach 24 billion USD in 2020. The institutions mentioned above predict that in 2014-2019 the value of this market will increase by approximately 4.5-5.3% on an annual basis [10, 11]. Figure 9 presents data related to BBC Research-developed assessment of the global welding technique market size.

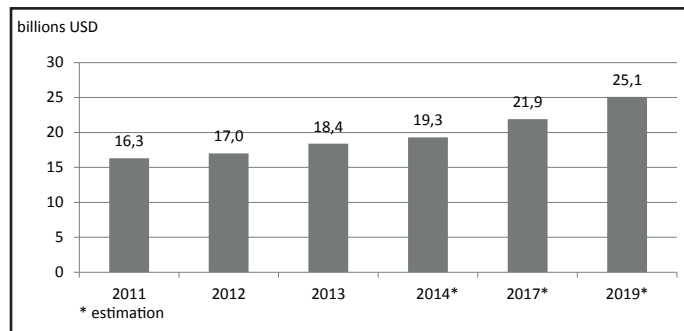


Fig. 9. Global market of welding equipment and materials including welding gases, welder's personal protective equipment, means of environmental protection, accessories and welding robots

ESAB predicts that the global welding technique market of 2012 was worth approximately 21 billion USD, in 2013 – 24 billion USD, and in 2014 – 25 billion USD. ESAB's global welding technique market analysis is based on the assessment of the market of filler metals (including those for welding medium-alloy steels, alloys and aluminium alloys), equipment and accessories, including welding equipment, equipment for manual plasma welding and cutting, equipment for gas welding and cutting, personal protective equipment, automated welding systems, robots and robotic stations and cutting equipment, including automated tables and cutting systems [12].

In 2013, experts of Victor Technology Holdings Inc., which, similar to ESAB, is part of the multinational Colfax Corporation concern, valued the global market of welding and cutting technique at approximately 15.9 billion USD. The assessment took into consideration the three primary product segments:

- cutting equipment, including gas cutting equipment, gas flow regulators, systems for plasma cutting and devices for arc-air gouging;
- equipment and accessories for arc welding;
- filler metals for welding, surfacing and brazing.

Experts of Victor Technology Holdings Inc. assess that in 2013 the market of filler metals for welding and surfacing made up half of the global welding technique market. In 2007-2013 the market share of this segment amounted to

between 50% and 57%. In the same period, the market share of welding equipment practically did not change and amounted to 24%. In general, in 2007-2013 the structure of the global welding technique market was relatively stable and free from greater fluctuations (Fig. 10) [12].

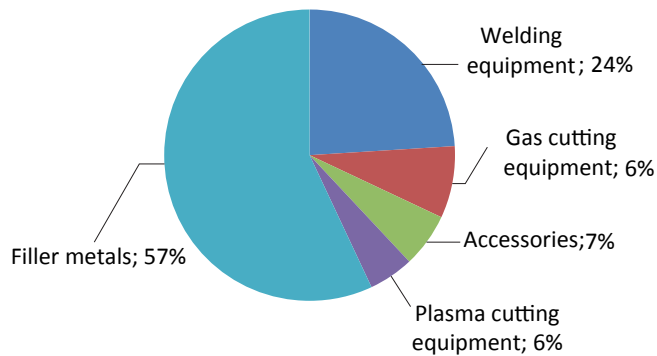


Fig. 10. Structure of the global welding technique market divided into major production groups in 2013

According to the Japanese publication *Japan Welding News for the World*, in 2013 the global consumption of welding materials amounted to 6.3 million tons. In the structure of the global consumption of welding materials, the major share belonged to covered electrodes (38%) and solid wires (37%). Table 1 presents data concerning the global consumption of welding materials in terms of quantity and global market share in 2011 and 2013 [13, 14]. It reveals that in spite of an increase in the global consumption of welding materials, the consumption of covered electrodes tends to fall, whereas the use of solid and flux-cored wire is on the increase, which indicates growing mechanisation and automation of arc welding processes.

Table 1. Structure of the global consumption of the major groups of welding materials in 2011 and 2013

Welding materials	Consumption, share			
	2011		2013	
	tons	%	tons	%
Covered electrodes	2,442,700	41.1	2,389,300	38.0
Wires for submerged arc welding	669,000	11.3	706,200	11.2
Solid wires	2,085,200	35.1	2,324,400	37.0
Flux-cored wires	748,700	12.6	863,700	13.8
In total	5,945,600	100.0	6,283,600	100.0

BCC Research analysed the global welding technique market divided into key technological segments, i.e. arc welding, resistance welding, oxygen cutting, laser welding etc. The analysis was concerned with the market size in terms of welding equipment and materials, welding gases, personal protective equipment, means of environmental protection, welding robots and accessories. According to BCC Research, in 2013 the global market of welding equipment and materials was worth 18.4 billion USD. Figure 11 presents the value-related structure of the global market of welding equipment and materials divided into technological segments of the welding technique market according to BCC Research assessment [10].

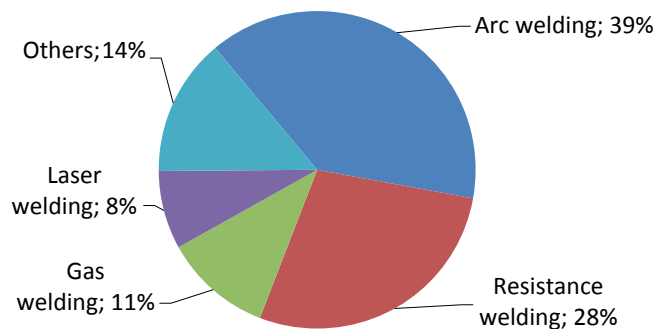


Fig. 11. Welding technologies in the global welding technique market in 2013

Traditionally, the welding technique market is dominated by arc welding. However, in the past 20 years its global market share has decreased by 3-5%, with an intensively growing popularity of concentrated energy beam welding and of other special welding processes. According to estimates prepared by experts from Lincoln Electric and Frost & Sullivan, in 2014 the value of the arc welding technique market amounted to approximately 20 billion USD, with an annual growth standing at 6% [15, 16]. Frost & Sullivan stated that in 2013 the value of the resistance welding technique market reached 570 million USD. It is suspected that in 2014 this market was valued at 640 million USD, and that annual growth in 2014-2019 will be 5.1%, to reach 820 million in 2019 USD [17].

The global welding technique market grows continuously both in terms of value and figures. The publication *Japan Welding News for the World* states that in 2010-2013 the global market of machines for arc welding and resistance welding grew annually by 14-15%. Table 2 presents data concerning the market of equipment for fusion welding and resistance welding expressed in figures and market share percentage in 2011 and 2012 [18, 19].

Table 2. Global market of equipment for arc welding and resistance welding in 2011 and 2012

Machines	Market share			
	2011		2012	
	thousands of units	%	thousands of units	%
for arc welding	1,133.65	96.2	1,301.70	96.0
for resistance welding	44.96	3.8	53.85	4.0
In total	1,178.61	100.0	1,355.55	100.0

Expressed in figures, in 2011 the global market of equipment for arc welding and resistance welding amounted to 1,178.61 items, to reach 1,355.55 units in 2012, with 96% made up by arc welding machines. In 2011-2012 the sales of welding equipment grew by approximately 15%; the growth in resistance welding machinery sales stood at 20%. The years 2009-2014 saw significant changes taking place in the regional structure of the welding technique market. Similar to the market of structural materials (steel, aluminium etc.), the welding technique market shifted towards Asia. Positive changes could be observed in the welding technique markets of China, India, Taiwan and the ASEAN countries. In 2014, the share of the Asiatic region countries, primarily of China and India, in the global welding technique market increased to 42%. A 2% increase in sales was observed in the Middle East countries (Iran), North (Mexico) and South (Brazil) Americas. In turn, the USA, European and Japanese markets saw slight decreases. Presently, the major regional segments of the welding technique market are Asia – 42%,

America 31% and Europa, Russia, the Middle East and Africa – 27% of the market. The primary users of welding technique are the building industry, transport and power (including oil and gas extractive industry, power generation, petrochemical industry, production of pipes, construction of pipelines etc.) sectors. Figure 12 presents the structure of the global welding technique market according to data by ESAB [20]. Frost & Sullivan and Transparency Market Research estimate that welding technique is on the increase in industrial and residential building engineering, cargo transport, automotive industry and power sector (particularly wind power). The industries presented above are recognised as the most important driving forces of the welding technique market. According to Frost & Sullivan, in 2011, the value of the market of weld-

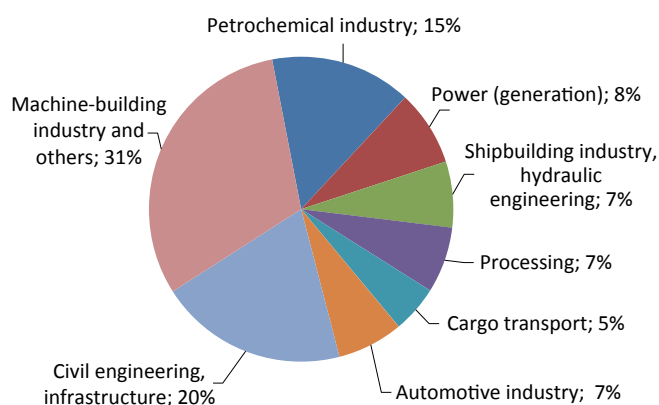


Fig 12. Structure of welding technique market divided into major industries in 2014

ing equipment and materials in the global power sector amounted to 445.5 million USD. It is expected that by 2017 the value of the welding technique market in the power sector will have reached 578.7 million USD, with an annual increment of 3.8%. A reason impeding the development of the global welding technique market is a low welding market increase in the shipbuilding, aviation, space and military industries. Experts of ESAB and Frost & Sullivan recognise wind power as the most promising and developmental [20] segment of the welding technique

market. Investments in welding equipment in this market segment continue to grow. ESAB experts estimate that each newly implemented MW of power requires 700 kg of electrode materials and 600 kg of flux.

Presently, the share of global power generation produced using wind farms does not exceed 2%, yet this type of power generation grows incessantly, particularly in Asian countries of the Atlantic Ocean region. In their research, experts of Frost & Sullivan also mention a welding technique sales increase in the sector of repair and renovation. In 2010, the sales of welding equipment and materials in this sector exceeded 2.2 billion USD, with an expected annual growth of 4% until 2017. The analysis of the recent welding technique market trends indicate that further development of welding technique will depend on the following factors:

- reduction of production costs and increase in efficiency as remuneration, materials used for welding materials and machinery production as well energy and fuel costs will continue to grow;
- improvements in welded structures and reduced mass of welds;
- greater use of high-strength steels, alloys and lightweight materials in welded structures;
- higher requirements related to reliability and quality of welded structures;
- higher degree of arc welding mechanisation and automation;
- greater use of automated and robotic welding processes;
- more extensive use of new welding techniques by means of concentrated (laser, electron) energy beams, friction welding and others.

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