

BORIS EVGENYEVICH PATON

Boris E. Paton is an outstanding scientist in the field of welding, metallurgy and technology of metals and materials science, prominent public figure and talented organiser of science, academician of the National Academy of Sciences of Ukraine, Academy of Sciences of the USSR and Russian Academy of Sciences, professor, honoured scientist and technologist of the Ukrainian SSR, laureate of the Lenin Prize and State Prizes of the USSR and Ukraine, Twice Hero of the Socialist Labour of the USSR, Hero of Ukraine, participant in the Great Patriotic War, and liquidator of accident at the Chernobyl NPP.

Together with his father Evgeny Oskarovich Paton, Boris Paton established the world-known Paton scientific school.

The international authority of B.E.Paton is a result of his versatile and extraordinarily fruitful scientific and engineering activity, and of his great effort to use results of the fundamental research for solving problems of the society.

For over 55 years B.E.Paton has been heading the internationally recognised research and technology centre – the E.O.Paton Electric Welding Institute of the National Academy of Sciences of Ukraine, and since 1962 he has been a permanent President of the Academy of Sciences of the Ukrainian SSR (now the National Academy of Sciences of Ukraine).

Boris Paton was born on the 27th of November 1918 in the family of Evgeny Oskarovich Paton, professor of the Kiev Polytechnic Institute.

In those years Evgeny Paton was a well-known expert in the area of bridge construction and chaired the bridge faculty. He was the author of original bridge designs and engineering structures, and was in charge of their construction. Being experienced in cooperation with many machine-building enterprises and participating in major construction projects, he was well aware of the strong dependence of progress in these industries upon utilisation of the new technology for materials joining – welding.

To make welding a reliable technological process, it was necessary to conduct comprehensive investigations into mechanics of welded structures, metallurgical processes, welding metal science and physics of the arc discharge, as well as develop welding equipment, consumables and new welding technologies. To address all these problems, the Electric Welding Institute was founded in 1934 by the initiative of E.O.Paton within the system of the Academy of Sciences of the Ukrainian SSR.

The intensive working activity of the father absorbed in solving a large number of scientific and technical problems, as well as in organisational matters, was witnessed by Boris Paton and, undoubtedly, affected formation of his character and attitude to work and people.

In 1941, Boris Paton graduated from the Kiev Polytechnic Institute and was assigned to the “Krasnoe Sormovo” plant in Gorky. In the following year he was

appointed to the Electric Welding Institute, which was evacuated at that time to the Uralvagonzavod Plant in Nizhnij Tagil. It was that famous Plant where in 1942 B.E.Paton started his manufacturing and scientific activity. From then, for 11 years, Boris Paton was working together with his father; those were the years of his growth as a scientific worker and researcher, and then a leader of a large scientific team.

Boris Paton proved to be one of the most talented students and a worthy successor of his father. He continued and brilliantly developed the work started by E.O.Paton.

During the war years the Institute focused all its efforts on helping the largest Ural Car Building Plant (Uralvagonzavod), and later - other plants that mastered the mass production of tanks.

Along with a big and intensive work at defence factories, the team of the Institute continued the research efforts. In 1942, V.I.Dyatlov discovered the phenomenon of self-regulation of electrode melting in submerged-arc welding. Investigation of this phenomenon by B.E.Paton, together with A.M.Makara, P.I.Sevbo and M.N.Sidorenko, allowed the development of portable, simple and reliable automatic welding devices, and the application of the simplest AC power units.

Each automatic device controlled even by an unskilled operator replaced the work of eight to ten experienced welders. Application of automatic welding devices under conditions of acute shortage of manpower solved the most important problem of defence production. All associates of the Institute headed by its Director took a direct part in assembling and setting up of welding equipment.

Tank T-34 manufactured on enormous scales by Uralvagonzavod and other factories of the country was recognised by experts to be the best medium-weight tank of the Second World War, and predetermined to a considerable degree our victory over fascism. Lives of many thousands of tank crews were saved thanks to the reliable welded armour.

In 1943, B.E.Paton was awarded the Order of the Red Labour Banner for the achievements in mechanisation and automation of welding operations used for the fabrication of military equipment.

Regardless of the fact that in the war years Boris Paton was extremely busy working in welding shops of the Plant, he completed a number of interesting investigations into static properties of automatic equipment for submerged-arc welding.

Further investigations in this field and their extension were the content of his thesis for a candidate of technical sciences degree, which Boris Paton defended in 1945.

In his later studies, Boris Paton showed that the automatic equipment providing a constant wire feed speed, fitted with power sources and fast-acting

voltage regulators, possessed the optimal characteristics. It was this conclusion that underlay the development of equipment for mechanised submerged-arc and gas-shielded welding.

For the development of semi-automatic submerged-arc welding equipment, in 1950 B.E.Paton and his colleagues, and also experts of the “Elektrik” Plant in Leningrad, were awarded the Stalin Prize of the USSR in the field of science and technology. Later on, this principle of control was used as a basis for building semi-automatic devices for gas-shielded welding.

Boris Paton was working fruitfully on completing investigations associated with the conditions of stable arcing and regulation of the arc. He successfully defended his theses for a doctor of technical sciences degree dedicated to this subject, and was elected a Corresponding Member of the Academy of Sciences of the Ukrainian SSR.

Investigations in the field of welding power units, and welding transformers in the first turn, were carried out under the leadership of B.E.Paton. Automatic submerged-arc welding was one of the most efficient processes in those years. The industry needed new developments in the field. And the Institute deployed research on metallurgical processes of submerged-arc welding. Within a short period of time the fundamentals of the theory of metallurgy of submerged-arc welding and surfacing were worked out, and a wide range of different-application fluxes was developed. New technologies were elaborated, and a high-capacity production of fused fluxes was arranged.

The Khartsyzsky Pipe Plant was the first in the country to produce high-quality large-diameter pipes, based on the above developments. Boris Paton was one of the founders of this production. This work was of a fundamental character in terms of arrangement and development of up-to-date mass production of large-diameter pipes at the Khartsyzsky, Chelyabinsky, Volzhsky, Vyksunsky and other factories for the construction of high-capacity gas transportation systems in the USSR. It became the lifetime work of Boris Paton.

The Institute developed a new process for submerged-arc welding in different spatial positions. This method allowed mechanisation of welding operations at construction sites. For the first time the method was applied to erect span structures of the Kiev Bridge across the Dnieper River, which was called after Evgeny Paton – chief ideologist of welded bridge construction and technical supervisor of designing and building of this unique structure. Later on, another new method of flux-cored wire arc welding with forced weld formation was developed, which was widely applied for the construction of span structures of the Moskovsky and Yuzhny bridges across the Dnieper River in Kiev and across the Volga River in Saratov, construction of main pipelines, metallurgical facilities, chemical apparatuses, and ship hulls.

In 1950, Boris Paton was appointed to the post of Deputy Director of the Institute on scientific work, and in 1953, after the death of Evgeny O. Paton, he

became the Director of the E.O.Paton Electric Welding Institute of the Academy of Sciences of the Ukrainian SSR.

Further progress of welding science, technology and production required that a systematic and planned approach be used on the scales of the entire country. Boris Paton developed the planned arrangement of research efforts of the Institute. He established business contacts with heads of industrial enterprises, National Economy Councils, Ministries and State Planning Committee of the USSR, arranged and headed preparation of proposals for development of welding in the USSR. In June 1958, the Central Committee of the Communist Party of the Soviet Union and the Council of Ministers of the USSR issued resolution “On Further Industrial Application of Welding Engineering”.

The resolution provided for the fundamental research to be conducted in the field of welding processes, development of equipment, materials and technologies, foundation of new research institutions and factory laboratories, construction of specialised facilities for production of welding equipment, consumables and welded structures. Other similar resolutions were passed during the five-year periods that followed. Their implementation predetermined the progress of welding science and technology in the second half of the 20th century not only in the USSR, but also in a number of foreign countries. The USSR became the leading country of the world in the field of welding, and our American colleagues called Kiev the world capital of welders.

Boris Paton has an exceptional ability to interact with people. He is always ready to support an interesting idea and estimate a work done at its true value. His enthusiasm, unique capacity for work and consideration for every staff member create a good working atmosphere at the Institute.

An example is the development of electroslag welding. While developing a method for field welding, G.Z.Voloshkevich, an associate of the Institute, discovered that molten slag with the electric current flowing through it could be used as a heat source. The process was called the electroslag one.

Boris Paton predicted a great future for this process. He managed to concentrate the efforts of the work team on solving the most important problems of electroslag welding. As a result, a new promising method for welding heavy sections of metal was developed within the short terms, which was verified under production conditions and made suitable for extensive application.

Application of electroslag welding radically changed the technology of production of such components as drums of pressure boilers, beds of heavy presses and rolling mills, wheels and shafts of hydraulic turbines, etc. Large-size cast and forged components were replaced by welded and welded-forged ones, which turned out to be much more cost effective.

In 1957, B.E.Paton and G.Z.Voloshkevich, together with workers of the Novokramatorsky Engineering Plant (Kramatorsk) and Krasnyi Kotelshchik Plant (Taganrog), were awarded the Lenin Prize for the development of the electroslag

welding process and manufacture of large-size critical-application parts on its basis. This work was marked by the Grand Prix at the International Exhibition in Brussels in 1958. A number of companies from industrialised countries of the world bought licences for application of this high-productivity welding method.

In November 1958, Boris Paton was elected a Full Member of the Academy of Sciences of the Ukrainian SSR.

Boris Paton believes that arc welding will continue to be the main welding process in the foreseeable future. He is paying much attention to further improvement and development of this process, and guides the team of the Institute to addressing topical problems in this area.

Boris Paton initiated investigations into the processes of formation of welding fumes and development of a new generation of low-toxicity welding electrodes. High-capacity workshops and factories for production of electrodes were built. Wide application of this development made it possible to radically improve labour conditions and decrease many times the rates of occupational diseases of welders. In the 1950s, the Electric Welding Institute started developing a new area – automation and mechanisation of the processes of hard-facing of working elements of mining machines and equipment with different materials to increase their wear resistance. Fundamental research was conducted to study the hard-facing processes by the submerged-arc, gas-shielded, self-shielding flux-cored wire and plasma jet methods. Unique surfacing equipment, consumables and technologies were developed. Commercial production of surfacing flux-cored wires was arranged. This area proved to be highly promising. The Institute is still active in it, and the technologies are widely applied in different industries.

In 1958, Boris Paton initiated development of new methods for mechanised welding of structures under field conditions, at erection sites, on building berths, and under the water, for which he suggested using flux-cored wire.

Extensive research was carried out to study metallurgical and technological peculiarities of this welding method. Self-shielding and gas-shielded wires were developed for different applications, and production of flux-cored wires was arranged. Now this area is among the leading ones in the world welding science and technology.

Research and development efforts on the method of semi-automatic underwater flux-cored wire welding opened new possibilities for exploration of the continental shelf, construction and repair of port systems, pipeline transitions through rivers, and other facilities.

Results of many studies by Boris Paton and his colleagues in the area of arc welding were published in the monographs he edited: “Technology of Electric Fusion Welding of Metals and Alloys” (Moscow: Mashinostroenie, 1974), and “Microplasma Welding” (Kiev: Naukova Dumka, 1983).

Boris Paton contributed significantly to the development of flash butt welding.

Pioneering investigations were completed to study the effect of short circuit resistance of flash butt welding machines on stability of melting and heating, and on weldability of metal. High efficiency of welding current feedback was proved. Ingenious designs of transformers were put forward, and theoretical principles for their calculations were elaborated. Systems for multifactor control of the flash butt welding process were developed for the first time in the world practice under the leadership and with the direct participation of B.E.Paton. Several generations of ingenious machines, which have been in operation for a few decades in many countries throughout the worlds, were built. Among them are rail welding machines, unique inside-pipe flash butt welding systems “Sever”, machines for welding of rocket parts made from aluminium alloys, and many others.

Boris Paton became interested in using high-power electron beams for heating metal in welding as early as in the fifties. It turned out that application of the electron beam holds high promise for welding various thick-walled vessels made from steels, high-strength alloys based on aluminium and titanium, and other materials. Complicated problems of ensuring stability of the electron beam in the atmosphere of metal vapours were solved, special features of formation of narrow and deep welds were determined, and control methods providing reproducibility of optimal welding parameters were developed. All this allowed the manufacture of the advanced equipment, which received international recognition.

Tungsten-electrode arc welding over the layer of an activating flux-paste, which was later called A-TIG welding, was developed by the E.O.Paton Electric Welding Institute in the middle of the 1960s. Evaporation of the activating flux can provide contraction of the arc column, increase the penetration depth several times, raise the productivity of welding, and improve the weld shape. This ingenious technology gained acceptance in the USSR and then in the CIS countries. The Paton technology PATIG obtained recognition also in the so-called “far foreign” countries.

Recently, Boris Paton has initiated research aimed at elaboration of theoretical fundamentals of the arc welding processes using activating fluxes. Main principles of the impact of arc contraction on characteristics of the heat and dynamic effects exerted on the weld pool were determined, and the mechanism of deep penetration of metal was explained.

At the end of the 1980s, B.E.Paton supervised the research efforts of the Electric Welding Institute to study hybrid (laser-arc and laser-plasma) processes of welding and treatment of materials. Designs of the direct- and indirect-action laser-arc plasma torches were offered, and different-application plasmatrions were built. New processes of hybrid laser-plasma welding and surfacing were

developed, including the process of hybrid laser-microplasma welding of small thicknesses of metals.

In the 1960s, B.E.Paton headed the research efforts to study technologies for production of different coatings and composite materials by electron beam evaporation of components and condensation of vapours on surfaces of parts or special substrates. The electron beam technology for deposition of coatings, which found application in a number of engineering sectors, allows many times extension of service life of different parts, e.g. gas turbine blades.

The electron beam hybrid nanotechnology is capable of filling up a niche between the thin-film and traditional technologies for manufacture of materials and parts. The key feature of the new technology is the possibility of implementing solid-state synthesis of the preset sequence of structures, the combination of which is a new product.

In the eighties, the Electric Welding Institute was active in investigations into the methods of thermal spraying of coatings using gas-oxygen flame and arc plasma, which were initiated by B.E.Paton. Equipment and consumables were developed to provide protective layers with different properties.

As early as in the first half of the sixties B.E.Paton put forward an idea of using welding to assemble metal structures in the open space, which was strongly supported by S.P.Korolyov.

In 1969, the first space welding technology, i.e. welding in space around the Earth, was implemented under the leadership of Boris Paton. Experiments on electron beam, plasma-arc and consumable electrode welding were carried out by cosmonaut V.N.Kubasov on board the “Soyuz-6” piloted spaceship. Peculiarities of weld formation under the zero gravity conditions were thus studied, and the possibility of producing tight and well formed welds in space was proved.

In 1979, the concept of depositing various metallic coatings on surfaces of the space station components and devices was successfully verified. Special device “Isparitel” was developed for this purpose, and the versatile hand tool (VHT) was built for welding, brazing and deposition of coatings. VHT was tested in the open space in 1984 by cosmonauts S.E.Savitskaya and V.A.Dzhanibekov. This experiment launched a package of systematic multipurpose investigations and experiments on optimisation of structural components and technology for installation of large orbital structures and facilities. In 1986, a structure in the form of a dismountable girder was constructed in space (Mayak experiment). The first brazing of connections of truss structures was carried out in 1991, and the unit for opening and deployment of multiple-use solar cells was built on the “Mir” orbital station.

Results of many years’ research and development efforts in the field of space technologies were presented in monograph “Welding in Space and Related Technologies” by B.E.Paton and V.F.Lapchinsky, which was published in 1997 in Great Britain. Then these results were summarised in book “Space:

Technologies, Materials, Structures” published in 2000 under the edition of B.E.Paton.

When assessing the contribution made by B.E.Paton to the development of the USSR space program, Yu.P.Semyonov, academician of the Russian Academy of Sciences and Chief Designer of rocket-space systems at RPC “Energiya”, who had been working with S.P.Korolyov for many years, writes:

“B.E.Paton belongs to the Grand Pleiad of Soviet scientists and designers, who made the USSR in the years of its existence a mighty and great power... He made an invaluable contribution to the science and practical application of welding. Thanks to him, we were the first in the world to develop the space technologies and conduct the first welding experiment in space... B.E.Paton is a prominent scientist of the 20th century. His distinctive and unique feature is to make a reality of ideas... He made a great contribution to rocket N1 (to explore the Moon)...He did much for spaceships “Soyuz” and “Progress”. He supervised the efforts on building unique devices to realise the space technologies. Cosmonauts S.E.Savitskaya and V.A.Dzhanibekov were the first in the world to prove high performance of these devices and technologies in the extra-vehicular activity”.

A big package of fundamental and applied research was completed under the leadership of B.E.Paton in the field of static and cyclic strength of welded joints, their resistance to brittle and fatigue fractures, and performance under the low-temperature conditions.

A range of prominent structures was fabricated, including, first of all, the unique all-welded bridge across the Dnieper River, which was named after E.O.Paton. Principles, approaches and structural-technological solutions optimised in designing and construction of this bridge cleared the way to a wide application of welding in bridge construction. That bridge obtained the recognition of the American Welding Society as an outstanding welded structure of the 20th century. The experience gained in construction of the E.O.Paton Bridge was utilised for building other bridges across the Dnieper River in Kiev (Yuzhny, Moskovsky, Gavansky (Harbour), Podolsky-Voznesensky, highway and railway bridges), as well as bridges in Dnepropetrovsk and Zaporozhie, and bridge across the Smotrich River in Kamenets-Podolsk.

Development of the technology for deployment of coiled tanks intended for storing oil and oil products was a striking example of the new approach to erection of prefabricated welded structures. This technology provided solution to the problem of reconstruction of the storage tank fleet of the country, which had been destroyed during the Second World War.

Building projects and technologies were developed in collaboration with the Research and Design Institute “Ukrproektstalkonstruktisia”. They were successfully realised in construction of TV towers in Kiev, St-Petersburg, Erevan,

Tbilisi, Vitebsk and Kharkov. The “Motherland” monument in Kiev is also among the outstanding welded structures.

The Electric Welding Institute gives special consideration to the problem of evaluation of strength of structures containing service defects, estimation and extension of their remaining life. Boris Paton was the initiator and scientific supervisor of the target science-and-technology program “Problems of Life and Safe Operation of Structures, Constructions and Machines”. Many research institutes, colleges, branch institutions and a large number of industrial enterprises were involved in accomplishment of this program. Important scientific-and-technical and practical results were generated in working out of methodological principles, technologies, methods and means for estimation and extension of service life of structures.

Much consideration is given to development of methods for non-destructive testing and diagnostics. Available are the automated units for ultrasonic inspection of welded joints in large-diameter pipes, bodies of drill bits, power plant components, and welded joints on light alloys and non-metallic materials. Investigations for application of low-frequency ultrasonic waves and contactless introduction of acoustic waves into test objects are underway.

Systems for continuous monitoring of welded structures, which have to meet increased safety requirements, were developed for the first time in Ukraine.

Procedures for prediction of mechanical properties and remaining safe life of welded joints and connections comprising crack-like defects, as well as degradation of materials during operations are available.

For many years the Institute has been active in research in the field of materials science. New structural materials and technologies for their manufacture are being developed, and relationships between composition, structure and properties for different-application materials are being studied. The Electric Welding Institute has become a major materials science centre, with highly qualified specialists conducting the most sophisticated research on materials science in the field of physics of metals, metal engineering, electron microscopy, mass spectroscopy, Auger spectrometry, analysis of gases in metals and welds, X-ray elemental analysis, etc.

In 1954, Boris Paton headed investigations on using the electroslag process for improving the quality of metals and alloys. As a result, a fundamentally new area was formed in metallurgy – electroslag remelting, which gained wide acceptance and international recognition within the shortest terms. Many countries throughout the world bought licenses for this process. It is used to improve properties of heat-resistant, stainless, tool, ball bearing and other steels and special alloys. At present, rotors of high-capacity turbines, mill rolls, pressure vessels, stop valves for heat and nuclear power plants, cast punching tools and other critical parts are manufactured from the electroslag remelting metal.

In 1959, the work on refining of metals and alloys by the electron beam was started. Electron beam melting turned out to be an efficient method to improve the quality of special steels and alloys based on nickel and iron, and an effective technological process for producing super pure niobium, titanium and many alloys on their base.

Electron beam technology for producing titanium ingots has made good progress over the last years. New high-strength titanium alloys doped with aluminium, zirconium, niobium and iron were developed, and commercial electron beam cold hearth melting units were built. Many of them have no analogues in the world practice.

The process, equipment and technology for plasma-arc remelting of metals and alloys were developed. Capabilities of the plasma-arc technology were enhanced owing to the development of AC plasmatrons, allowing an essential improvement of reliability of the design of melting units and power sources.

Ladle treatment of metallurgical melts has been extensively applied in the world metallurgical practice in the last years. The E.O.Paton Electric Welding Institute developed new types of flux-cored wires, containing highly reactive elements for microalloying, modification and desulphuration of steels and cast iron, as well as technologies and equipment for manufacturing large-diameter flux-cored wires.

The injection metallurgy method is widely applied at metallurgical works of Ukraine and Russia. Dozens of millions of tons of steel melts have been treated by this method.

The Electric Welding Institute is successfully conducting research in the field of soldering and brazing of metals and alloys. New brazing filler metals and technologies are widely employed for fabrication of lattice rocket wings and components of aircraft engines, space engineering and drilling industry equipment.

Gigantic oil and gas deposits were discovered in the USSR during the post-war years. They were mainly located in Central Asia, Western Siberia, North Urals and other remote regions. So, it was necessary to construct high-capacity main gas and oil transportation systems to transport oil and gas to western regions of the USSR and abroad.

Under the guidance of B.E.Paton, the Electric Welding Institute completed a package of work on development of unique ingenious technologies and equipment for flash butt position welding of pipes, namely “Sever” systems. More than 70,000 kilometres of pipelines, including about 6,000 kilometres of large-diameter gas pipelines in the Extreme North, were welded by the flash butt process.

The ingenious technology for automatic position butt welding of pipes by using self-shielding flux-cored wire with forced weld formation – “Styk” system – was also developed. This technology was used to construct more than 10,000

km of main gas and oil pipelines, including “Druzhba”, “Central Asia – Centre”, “Urengoj – Pomary – Uzhgorod”, “Khiva – Beineu”, “Shebelinka – Ismail”, “Yamal – Western Border”, “Yamal – Povolzhje”, etc., as well as other oil and product pipelines.

Prof. Nikolai K. Baibakov – a major authority in the oil and gas complex of the country, who was the People’s Commissar of oil industry during the war years, and then Chairman of the USSR State Planning Committee for more than 22 years, said: *“Boris Evgenyevich Paton, the President of the Academy of Sciences of Ukraine and Director of the E.O. Paton Electric Welding Institute, had a tremendous influence on progress of oil and gas construction, and development of oil and gas industry of the former Soviet Union ... National manufacturing of arc welded pipes was established with his direct participation ... His priority influence on forming the entire welding policy in the oil and gas complex is indisputable. B.E.Paton is making a great contribution to determination of the extremely important parameter of pipelines – their remaining life... The most important point is that all these technologies, machines and welding consumables were brought up to a level of the widest acceptance..... Not less is done also on the advanced technologies, and solving the scientific and engineering problems for a new generation of pipeline systems, which will be built in the 21st century”*.

Boris Paton pays great attention to implementation of the achievements of modern science and technology in medical practice.

In the 1900s, he suggested using the welding processes for joining live tissues and organised a creative team of welding scientists and surgeons. This cooperation enabled the development of a new method for joining (welding) live tissues. Properties of tissues of different organs of a human body were studied, new welding equipment and methods for control of the welding process were developed, mathematical simulation of the processes of heating of tissues at high-frequency currents flowing through them was performed, and electrophysical properties of the biological tissues and strength of the welded joints were experimentally determined. Electric current sources for the welding units equipped with automatic control systems, and instruments for welding different types of biological tissues were developed. New samples of the equipment were successfully tested by medical establishments. The extensive experience has been accumulated by now – more than 30,000 surgical operations have been conducted on humans. The method of welding live tissues is used in clinics of Kiev and 11 regions of Ukraine, and is being verified in clinics of Moscow, St-Petersburg, and foreign countries outside the CIS. A shortening of surgical operation time has been achieved, the probability of post-operative complications has been reduced, and blood losses have been decreased. The package of work on welding of live tissues performed under the leadership and with the active creative participation

of B.E.Paton was awarded the State Prize of Ukraine in the field of science and technology.

B.E.Paton pays much attention to the international activity of the Institute and its scientists. The Electric Welding Institute is a permanent member of the International Institute of Welding (IIW) and European Welding Federation (EWF). Collaborative scientific projects, exchanges of delegations and specialists, presentation of research results in prestigious foreign publications, holding of international conferences, training of highly qualified personnel, selling of licenses for materials, equipment and technologies, organising of international exhibitions and participation of the Institute scientists in them – this is a by far incomplete list of international activities of the Institute. “Avtomaticeskaya Svarka” (The Paton Welding Journal), “Special Electrometallurgy”, “Technical Diagnostics and Non-destructive Testing” journals are published and translated into English under the guidance of Boris Paton.

This enables informing the international scientific-and-technical community of the results of research and new developments of the Institute.

Dozens and hundreds of talented scientists and engineers have grown at the Institute. There is a considerable number of academicians and corresponding members of the NAS of Ukraine among the patonovites. Associates of the Institute defended over 130 doctoral and more than 700 Ph.D. theses. Many developments mentioned above are the result of the work of a large and united team. The unity of the team is provided by personal traits of its leader – Boris E. Paton.

One of the basic principles set forth by E.O.Paton when founding the Institute, and further developed by B.E.Paton, is conducting a purpose-oriented fundamental research and keeping a close connection between science and manufacturing. This principle has been consistently implemented during an almost 75 years’ history of the Institute.

Scientific departments of the Institute, design department, experimental shops, experimental design-technological bureau, engineering centres, experimental productions and pilot plants have been established during the entire history of the Institute. These are integral links in the system of organisation of research and introduction of its results into production. Realisation of this system allowed the development of unique structures, equipment, materials and technologies, the application of which had a great influence on progress of many industries, namely mechanical engineering, shipbuilding, rocket-space complex, aircraft engineering, power generation, mining industry, metallurgy and chemical production, development of pipeline transportation systems, construction industry, etc.

Dedicated activity of the Institute staff was highly appreciated by the state. The Institute was awarded the Orders of Lenin, October Revolution, Labour Red

Banner, and many of the Institute employees were awarded the orders and medals of the USSR and Ukraine.

Nine developments, in which associates of the E.O.Paton Electric Welding Institute were involved, received the USSR Lenin Prizes in the field of science and technology, 24 developments were awarded the USSR State Prizes, and 34 developments – the State Prizes of the Ukrainian SSR and Ukraine.

Many years of selfless efforts of the Institute staff led by Boris E. Paton have won it the worldwide recognition.

In 1962, Boris Paton was elected a Full Member (academician) of the USSR Academy of Sciences in speciality “Metallurgy and Technology of Metals”. In that same year the scientists of the Academy of Sciences of the Ukrainian SSR unanimously elected B.E.Paton the President of the Academy of Sciences of the Ukrainian SSR (now the National Academy of Sciences of Ukraine). Profound understanding of the role of science in society, its goals and objectives, high international scientific authority, devotion to science, inexhaustible energy and high moral standards, social and political activity, and experience of leading a large scientific staff became the decisive arguments for election of Boris Evgenyevich to the post of the President of the Academy of Sciences of Ukraine. Since that time, for 46 years he has been at the head of this leading scientific organisation of Ukraine. In keeping with the Charter of the Academy, he was nine times unanimously re-elected the President of the Academy.

In this key position his talent of the organiser of research became even more evident. A new structure of the Academy of Sciences and its new Charter were developed under his leadership. They are aimed at the most efficient use of the scientific potential and means, their focusing on solution of the most important fundamental problems of science, having a crucial importance for economy of the country.

Dozens of new institutions and organisations were set up in the system of the Academy of Sciences of the Ukrainian SSR by the initiative of B.E.Paton and with his active support, thus allowing performance of more extensive and profound studies in the most important scientific areas.

He is constantly insisting on precise definition of the scientific profile of each institute, making sure that each of them becomes the leading organisation in its field in the Republic, state and in the world. He takes drastic measures to ensure that all the academic institutes are provided with up-to-date materials and technical facilities. He organises extensive housing construction for the Academy staff, and a whole new region of Kiev, called Akademgorodok, was thus founded.

The Academy of Sciences of the country becomes the chief scientific centre of the country, where extensive research is performed on urgent problems of natural, engineering, social sciences and humanities. Institutions of the Academy take up significant positions in individual sectors of mathematics, theoretical physics, solid-state and low-temperature physics, radiophysics and

radioastronomy, materials science, cybernetics and computer engineering, neurophysiology, molecular biology, microbiology, virology and genetic engineering, and in a number of other fields of knowledge.

Unique and high-capacity pilot-production base was formed within the Academy, and new types of relations between science and manufacturing gained acceptance.

Boris Evgenyevich is trying to set up academic institutions in the main regions of the country. In 1965, an academic research centre was set up and a university was opened in the city of Donetsk by his initiative. Later on, a number of other research centres of the Academy of Sciences of the Ukrainian SSR were established, which are successfully functioning till now. These are the Western (Lvov), Southern (Odessa), North-East (Kharkov), Pridnieprovsky (Dnepropetrovsk) and Crimean (Simferopol) Research Centres. The research centres have the functions of regional inter-industry bodies for coordination of scientific activity.

In 1963, B.E.Paton was elected a Member of the Presidium of the Academy of Sciences of the USSR. His work in this position allowed him to become familiarised with the activities of institutes of the Academy of Sciences of the USSR, study the experience of functioning of the Presidium and its departments. Trustful business relations and creative contacts were formed between B.E. Paton and academician M.V.Keldysh, President of the Academy of Sciences of the USSR, which were then developed into friendship and mutual respect.

Boris Paton formed good businesslike relations with V.A.Kirillin, Chairman of the USSR State Committee on Science and Technology, A.P.Aleksandrov, G.I.Marchuk and Yu.S.Osipov, Presidents of the Academy of Sciences of the USSR, M.A.Lavrentiev, founder and first Chairman of the Siberian Division of the Academy of Sciences of the USSR, and many other scientists. This allowed organising cooperation of Ukrainian scientists with scientists from Moscow, Leningrad, Novosibirsk and other regions of the Russian Federation and other Soviet republics, and, without doubt, promoted progress of science in Ukraine. These relations facilitated solving major issues in development of individual scientific areas, establishment of inter-industry science-and-technology centres (IISTC), and promoted international scientific-and-technical cooperation.

Close cooperation between the Academy of Sciences of the Ukrainian SSR, Academy of Sciences of the USSR, USSR State Committee on Science and Technology and academies of sciences of the Union republics promoted progress in many new scientific areas in Ukraine, establishment of new institutes and engineering centres, and consolidation of international reputation of the Academy of Sciences of Ukraine.

Boris Paton initiated major integrated science-and-technology programs for individual industries, transportation, communications and agriculture. While

fulfilling these programs, scientists of the Academy made an outstanding contribution directly to solving the urgent problems of development of the national economy. This form of organisation of the scientific activity was universally recognised.

Boris Evgenyevich was the organiser of a number of scientific councils. In 1966, he was at the head of the USSR Scientific Council on problem “New Welding Processes and Welded Structures”. The Council united the USSR scientists and specialists, and was functioning effectively from 1958 till 1991.

In 1972, the International Scientific-and-Technical Council of the COMECON Member-Countries on welding problems was set up by the initiative of Boris Evgenyevich. Owing to the activity of the Council, which was successfully functioning till 1992, many scientific and engineering organisations of the COMECON Member-Countries grew to the state-of-the-art research level, and had a great influence on progress of welding in their countries.

Following the advice of M.V.Keldish, B.E.Paton organised the Scientific Council at the Presidium of the Academy of Sciences of the USSR on problem “New Processes of Manufacturing and Treatment of Metallic Materials”, which united scientists of academic institutions and specialists of many other departments, and promoted development of materials science in the Academy of Sciences of the USSR, Russian Academy of Sciences and National Academy of Sciences of Ukraine. Many materials scientists and metallurgists, who were active at the Council, were elected into the Academy of Sciences of the USSR and Russian Academy of Sciences with the support of Boris Evgenyevich, and made a great contribution to development of the materials studies.

Boris Paton has the fundamental understanding of the role and place of science in addressing humanitarian problems of the society. While placing high emphasis on development and commercial application of advanced technologies, he, at the same time, seeks substantiated scientific estimates of their effect on the environment and humans. Led by Boris Paton, big teams of scientists of the Academy made predictive estimates of the negative ecological and social-economic consequences of large-scale drainage and irrigation meliorations in Ukraine, intensive chemisation of agriculture, and diversion of part of the runoff of the Danube and Dnieper Rivers.

Boris Paton adhered to his principles also in the issue of construction of a nuclear power plant in the Chernobyl region. Unfortunately, his warnings were fully confirmed by the universally known events of 1986 at the ChNPP.

Outstanding capabilities of Boris Evgenyevich Paton as a leader, scientist and organiser were fully revealed during the memorable days of the Chernobyl tragedy.

Teams of many institutes of the Academy of Sciences of the Ukrainian SSR and its Presidium became involved in the activities on liquidation of consequences of the accident from its very first days. Hundreds of scientists,

specialists of the Academy of Sciences, ministries, departments, and enterprises of Ukraine took part in this work.

Boris Paton led the efforts on preparation of proposals for decision-making authorities of Ukraine and the USSR Government Commission. Later on, in September 1997, B.E.Paton headed the Advisory Board of Independent Experts on finding comprehensive solutions to the problems of the Chernobyl Nuclear Power Plant, newly established by the President of Ukraine.

In 2004 – 2005, the “Academperiodika” Publishing House published the two-volume edition “Chenobyl 1986 – 1987” (volume I – “Documents and Memoirs”, volume II – “Participation by Institutions of the NAS of Ukraine in Overcoming Consequences of the Catastrophe”). Documents given in this fundamental work provide an objective and comprehensive coverage of the role of the Academy of Sciences of the Ukrainian SSR and self-sacrificing efforts of the staff of the academic institutes under the leadership of its President.

The goals defined by the President are being successfully pursued even now by the staff of many academic institutes. The team of the Institute for Problems of Safety of Nuclear Power Plants and expeditions from many other institutes of the NAS of Ukraine are continuously working in Chernobyl.

After disintegration of the Soviet Union and formation of independent Ukraine, under conditions of long-term economic and financial crisis, which did not spare the Academy, its President managed to preserve the Academy and its major scientific schools.

The status of the Academy as a supreme government research organisation was secured at the legislative level, principles of its academic self-administration were preserved, its restructuring was accomplished in keeping with the new conditions, and fundamental and applied studies were focused on addressing the urgent problems of formation of the state.

New priorities were identified in the field of natural, engineering, social sciences and humanities. A number of new institutes and centres of socio-humanitarian profile were established.

The world level of research was preserved in several areas of mathematics, informatics, mechanics, physics and astronomy, materials science, chemistry, molecular and cell biology, and physiology. The contribution of scientists of the Academy to fundamental and applied research in Ukraine is increasing. New technologies, materials and computer facilities have been developed, and new mineral deposits have been discovered, etc.

The Institute of Economics, Institute for Economic Forecasting, Institute for Economic and Legal Research, Institute for Market Problems and Economic-and-Ecological Research, Institute of Regional Research, Institute for Demography and Social Studies, Institutes of Ukrainian Studies, Oriental Studies, Political and Ethnic Studies, Sociology, Ukrainian Archaeography and Source Studies,

Ukrainian Language, as well as other departments, institutions and centres have been established and are successfully functioning.

The Institutes of the Academy take an active part in working out of the innovative programs on economic development of Ukraine, investigation of its history, culture and language.

Organisation of fundamental and applied research is being improved, and priorities are being determined in development of individual scientific area and interdisciplinary studies. Among them are such programs as “Nanosystems, Nanomaterials and Technologies”, “Sensing Systems”, “Intelligent Information Technologies”, “Hydrogen Power Generation”, “Power Saving”, “Problems of Demography and Development of Mankind”, etc.

A large package of R&D efforts on the technology, equipment and materials under the “Resource” program, headed by B.E.Paton, has been successfully completed. The Academy is planning to further develop the work in this area.

Boris Evgenyevich is continuously concerned about young scientists, attracting talented young people into science, supporting them financially and trying to improve their living standards. Youth scientific projects are being funded, and dormitories for post-graduates are being built and reconstructed.

B.E.Paton makes a lot of efforts for preservation and development of international scientific cooperation and foreign economic contacts with business partners from foreign countries.

Ukrainian scientists participate in many collaborative programs. Project competitions have been conducted together with the Science and Technology Centre in Ukraine, Russian Foundation for Fundamental Research, Russian Humanitarian Sciences Foundation and Siberian Division of the Russian Academy of Sciences.

B.E.Paton is one of the initiators of formation and preservation of common scientific space within the Commonwealth of the Independent States. In 1993, the International Association of the Academies of Sciences (IAAS) was established, which united national academies of 15 countries of Europe and Asia. Boris Evgenyevich is the permanent President of this Association. The Scientific Council of IAAS on Advanced Materials is functioning under his direction.

Academician B.E.Paton is an Honorary President of the International Engineering Academy, member of the Academia Europaea, Honorary Member of the Roman Club, International Academy of Technological Sciences, Honorary Member of the International Academy of Sciences, Education and Arts, International Aeronautical Academy, Foreign Member of the academies and scientific-and-technical societies of many countries. Dozens of domestic and foreign universities elected academician B.E.Paton an honorary doctor, including the Moscow M.V.Lomonosov State University, Kiev T.G.Shevchenko National Research University, St-Petersburg State Technical University, National

Technical University of Ukraine “Kiev Polytechnic Institute”, Moscow State Physical-Technical University, etc.

B.E.Paton performed and continues performing extensive public work. He was many times elected a Deputy of the Supreme Soviet of the USSR and Ukrainian SSR, Deputy Chairman of the Council of the Union of the USSR Supreme Soviet, member of the Presidium of the Supreme Soviet of the Ukrainian SSR, member of the Central Committees of the Communist Party of the Soviet Union and Communist Party of Ukraine. The list of his positions is very impressive. He is successfully working in these positions owing to the deep sense of personal responsibility to the state, people and his own conscience.

In addition, he has such traits as outstanding organisation, efficiency, rare ability of precisely grasping the point, and immediately making the right decision.

This heavy load is made easier to bear by his good physical shape, which he has preserved up to now owing to his active life style, regular and dedicated sports activities, including tennis, water skiing and swimming.

Yu.S.Osipov, President of the Russian Academy of Sciences, has been the B.E.Paton’s friend and cooperation partner for many years. Characterising Boris Evgenyevich, he said: *“The life of B.E.Paton – in science, in the sphere of research organisation and practical implementation of scientific achievements, his public and state activity – is truly a great feat for the sake of the scientific progress and for the sake of the future”*.

For his great services to the science and the state, B.E.Paton was awarded the high titles of the Twice Hero of Socialist Labour of the USSR and Hero of Ukraine. He is the knight of four Orders of Lenin, Orders of October Revolution, Labour Red Banner, Friendship of Nations, orders of the State, Prince Yaroslav the Wise of the 4th and 5th Degrees, Orders of the Russian Federation “For the Services to Motherland” of the 2nd Degree and “Order of Honour”, Order of Frantsisk Skorina of the Republic of Belarus, Order of Honour of Georgia, Order “Dostyk” of the Republic of Kazakhstan, and many other awards of the CIS countries. B.E.Paton is a laureate of the Lenin and State Prizes of the USSR and Ukraine in the field of science and technology. He was awarded the M.V.Lomonosov, S.I.Vavilov and S.P.Korolyov Gold Medals, A.Einstein Silver Medal of UNESCO, and many other prizes and decorations.

Boris Evgenyevich is utterly devoted to the Science, Institute, Academy and Motherland.

Today it is impossible to imagine the Electric Welding Institute and National Academy of Sciences of Ukraine without B.E.Paton. His worldly wisdom, tremendous experience and international authority in science and society allowed preserving the scientific potential of Ukraine.

Boris Paton is a leader, fighter, creative personality, deeply decent and kind man, possessing fantastic energy and capacity for work, enormous experience, deep knowledge in many areas, and ability to continually learn. He has a

generous nature and quick analytical mind. He is democratic, well-wishing, open for communication, affable, and always ready to support a person in need and help him.

It is symbolic that Boris Evgenyevich was born on the day of foundation of the National Academy of Sciences of Ukraine. In 1998, at the celebration of the 80th anniversary of the Academy and its President, the huge hall of the “Ukraine” palace rose in applause after the announcement that B.E.Paton was the first person in the country to be awarded the title of the Hero of Ukraine.

This is the kind of person our dear Boris Evgenyevich is.

Boris Paton is meeting his 90th birthday full of creative ideas, indomitable wish to work and enhance the contribution of science to prosperity of our state – the independent Ukraine. Let us wish him new successes, good health and much happiness with all our hearts.