



K.A. YUSHCHENKO IS 75



Konstantin A. Yushchenko, famous scientist in the field of welding technology and welding materials science, Doctor of Technical Sciences, Academician of the National Academy of Sciences of Ukraine, Professor, Honoured Worker of Science and Technology of Ukraine, laureate of the State Prize of the USSR, Prize of the Cabinet of Ministers of the USSR and Evgeny Paton Prize, and Deputy Director on scientific work of the E.O. Paton Electric Welding Institute, was 75 in December this year.

After graduating from the Kiev Polytechnic Institute in 1958, K.A. Yushchenko started his labour activity at the E.O. Paton Electric Welding Institute, where he worked his way up from engineer-experimentalist to deputy director.

Here he defended his candidate (1965) and doctor (1982) theses, and was awarded the title of professor (1987). He was elected Corresponding Member (1990) and Academician (2003) of the NAS of Ukraine. He was the head of a laboratory (from 1970), and then (since 1978) the head of the Department for Metallurgy and Technology of Welding High-Alloy Steels and Alloys.

The main area of his activities is development of new metallic materials, processes for their production and technologies for welding and surface engineering. The range of research includes development of well-weldable steels and alloys, elaboration of theoretical principles for welding these materials to manufacture parts intended, in particular, for operation under extreme conditions, under the effect of aggressive environments, cryogenic and high temperatures, radiation and intensive magnetic fields.

During a period from 1962 till 1965 K.A. Yushchenko completed a cycle of work on the theory of welding of steels of the ferritic-austenitic grade. He established the principles of variations in physical-mechanical and corrosion properties of metal of a welded joint with multi-component phase composition, and studied the selective character of electrochemical dissolution of

phases depending on alloying and linear sizes. This served as a basis for the development of new ingenious systems of steels and welds sparsely alloyed with nickel, welding consumables and processes providing their wide application in chemical engineering. From 1965 K.A. Yushchenko was in charge of the research at the Academy of Sciences of the UkrSSR in the field of development of new weldable steels and alloys for cryogenic engineering. The integrated efforts were made in close collaboration with VNIIKriogenmash, I.P. Bardin TsNIChermet (Moscow), Chelyabinsk Metallurgical Works (Chelyabinsk), Uralkhimmash (Sverdlovsk), Spetstekhmontazh (Baikonur), factories «Dneprospetsstal», Novo-Kramatorsk Machine-Building Works, Izhora Heavy Machine Building Plant and other organisations of the former Soviet Union. The problem of optimisation of compositions of steel and weld metal was solved on the basis of requirements for high specific strength, resistance to embrittlement under different loading conditions within a temperature range of 4.2–293 K, including in intensive magnetic fields and under irradiation and thermal shock loading. The investigations completed, along with the theoretical work, allowed the development of a range of fundamentally new well-weldable steels for cryogenic engineering, welding consumables and joining processes. For the first time in the world practice the process of melting of cold-resistant steels with the super-low carbon content in 100 t arc furnaces at the Chelyabinsk Metallurgical Works was developed in the USSR. This was used as a basis for the development of a new scientific direction – welding cryogenic materials science, which is recognised not only in the CIS countries, but also abroad. The package of research was completed on evaluation of structural strength of welded joints at cryogenic temperatures. Theoretical investigations were used as a ground for the development of the design codes and methods, which are applied in Ukraine, Russia and other countries to design the new types of cryogenic structures, where low-temperature strengthening of metal is used. More than 50 patented grades of steels, welding wires, electrodes and fluxes developed under the leadership and with participation of K.A. Yushchenko are employed in cryogenic engineering. They were applied in such major projects as «Buran» (launching system), «Tokamak-7» and «Tokamak-15» (superconducting power system of MHD generator), in large-size space simulator, life support unit, on-board engines of space systems, and new generation of gas turbine engines. New steels and consumables, as well as technological processes developed by

K.A. Yushchenko are included as candidates for building of the international fusion reactor «ITER» and stellarator.

In 1985 K.A. Yushchenko developed new postulates concerning the processes that cause cracks in the welds during solidification and reheating. The role of dislocation and segregation processes for the upper and lower brittle temperature ranges, and their part in formation of cracks were theoretically substantiated and experimentally proved. In 1975–2005 K.A. Yushchenko completed the package of work on investigation of weldability of materials. A new theory of weldability was developed, and materials joining methods were classified as to the aggregate state of the matter. The new weldability criterion used to evaluate the degree of degradation of a material from the energy standpoint widens technical capabilities for production of permanent joints in all structural metals and non-metals. Based on investigations of the processes of embrittlement of high-chromium steels of the Fe–20Cr system, having the bcc structure, the team of scientists of the E.O. Paton Electric Welding Institute headed by K.A. Yushchenko, in collaboration with the Physico-Technological Institute of Metals and Alloys of the NAS of Ukraine, suggested to control the segregation phenomena in recrystallisation of metal due to controlled dispersion of impurities in the bulk of grain. This work opened up a new advanced direction in development of mass-application well-weldable nickel-free corrosion-resistant high-chromium ferritic steels.

One of the scientific achievements is the theory of welding of high-alloy steels with super-equilibrium nitrogen content, which was developed by K.A. Yushchenko and co-workers. The cycle of the work allowed substantiating the principles of providing sound joints on a new grade of metals characterised by super-equilibrium alloying with gases. Investigations on the kinetics of denitriding made it possible to determine the conditions of existence of quasi-equilibrium states in interface regions of solidifying metal, as well as the role of phase changes of metal in the «liquid-gas» system. Consumables and processes allowing welding of metal with a super-equilibrium nitrogen content of up to 1 % were developed for the first time in the world practice.

In 1986–2005 K.A. Yushchenko took an active part in the work on the development of new consumables

and processes for treatment of surfaces and deposition of coatings. He conducted investigations on the development and application of special flux-cored wires for wear- and corrosion-resistant surfacing, new types of wires and powders based on refractory materials, and compositions of alloys with amorphous structure. The consumables and processes developed found wide commercial application. They include such processes as vanadium carbide plating, plasma-detonation treatment, discharge-plasma treatment and microplasma spraying. Being original, many of them were covered by patents and found recognition abroad.

K.A. Yushchenko is very active in organisation of science. In 1989 he was elected a Vice-President of the International Institute of Welding. From 1986 till 1992 he was a Vice-Chairman of the National Welding Committee of the USSR, since 1993 – Chairman of the National Welding Committee of Ukraine, and since 1990 – leader of area «Permanent Joints and Coatings» and program «New Substances and Materials». He is the Head of the Coating Section at the CIS Inter-State Science and Technology Council, and since 1983 – member of Bureau of the Department for Physical-Technical Problems of Materials Science at the NAS of Ukraine, member of the Specialised Board on Defence of Theses at the E.O. Paton Electric Welding Institute, member of editorial boards of the «Avtomaticheskaya Svarka» (Automatic Welding) and «Svarshchik» (Welder) journals, member of the Technical Committee and Select Committee on joining and coating of advanced materials for aircraft engineering at the International Institute of Welding. Since 1984 he is a member of management boards of the international organisations on cryogenic engineering and cryogenic materials.

K.A. Yushchenko is the author of more than 750 publications and inventions, including 7 books. Over 40 candidate and 6 doctor theses were trained under his supervision.

K.A. Yushchenko was awarded the Honorary Diploma of the Supreme Soviet of the UkrSSR, Order of Friendship of People, Order of Yaroslav the Wise of the V degree, and medals. In 1994 he was elected an active member of the International Electrotechnical Academy (Moscow).

Associates of the E.O. Paton Electric Welding Institute and Editorial Board of «The Paton Welding Journal» sincerely congratulate Konstantin A. Yushchenko with his glorious jubilee and wish him strong health, happiness and new creative achievements.