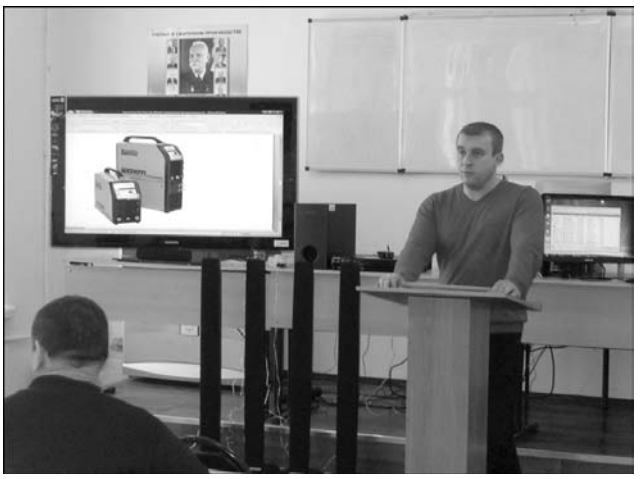
E.M. Kvitko, Deputy Director of Karaganda Professional Lyceum #26, talked about development of KR state general education standards of technical and professional post-secondary education. A paper on technological features of welding and control of pipeline root weld was delivered by Zh.E. Abilov, engineer, first graduate of Welding Chair of KarSTU. I.M. Pokasov, Director of SPA «Tekhnik» Ltd., Karaganda, reported on development of a procedure of control and assessment of weld quality by defect area, which gave rise to lively discussion in the Conference. Another serious discussion was held in connection with the presentation of S. Linovsky, Chief Welder of «Welding Group», Almaty, on FastROOT technology of welding the weld root by a modified short arc.

In conclusion of the first day of the Conference, I.A. Bartenev talked about the experience of student training in the welding speciality at KarSTU in keeping with the Bacheloriate system, and assigning the graduates to work in major companies and firms in Western and Central Kazakhstan.

On the Conference first day a tour to KarSTU welding laboratory was conducted, where presentation of new KEMPPI equipment was held. In particular, Master TIG MLS^{TM} 3000/3003 ACDC machine for welding and tack welding of sheet metal by Microtack technology was demonstrated in operation. Setting up of the modes and welding by this machine were demonstrated by S. Linovsky. The new technology excited great interest of Conference participants, who themselves tried welding with Maser TIG MLS^{TM} 3000/3003 ACDC machine. On the second day of the Conference activities, a meeting of chief welders of enterprises, head of welding laboratories and welding and NDT specialists was held, where the draft of new Rules of Certification of Welders and Welding Fabrication Specialists of KR, as well as development of a system of welding fabrication certification in the country, was discussed. I.A. Bartenev delivered a paper on this subject.

Candidates for the National Certification Committee on welding fabrication of KR were nominated and its functions were outlined. Specialists present in the meeting approved these proposals and spoke in favour of as prompt as possible approval of the new Rules of Certification of Welders and Welding Fabrication Specialists of KR in the Ministry of Emergency Situations of KR and introduction of a system of welding fabrication certification in the country.



Presentation by S. Linovsky

The subject of collective subscription to «Avtomaticheskaya Svarka» journal was also discussed in the Conference. More than 10 representatives of companies and enterprises expressed their wish to become collective subscribers to this prestigious journal.

After completion of the Conference A.G. Kozmin, Director of «Welding Technologies» Ltd., Atyrau, expressed a wish to provide assistance to the welding laboratory and supply free of charge three advanced welding machines of KEMPPI for training KarSTU students, which will promote an improvement of the quality of training young specialists of welding fabrication in Kazakhstan's only higher educational establishment with such a speciality.

Dr. I.A. Bartenev, KarSTU

PROBLEMS OF LIFE AND SAFE OPERATION OF STRUCTURES, CONSTRUCTIONS AND MACHINES (Final Scientific Conference at the E.O. Paton Electric Welding Institute of the NAS of Ukraine)

On January 22, 2010 the Final Scientific Conference devoted to consideration of scientific and applied results obtained during 2007–2009 in fulfillment of projects of purpose-oriented program of the NAS of Ukraine «Problems of Life and Safe Operation of Structures, Constructions and Machines» was held at PWI. Scientific leaders and performers of projects, as well as representatives of interested ministries, departments, educational and branch institutes, industrial enterprises and organizations participated in the Conference activities.

The Conference was opened by academician B.E. Paton, President of the National Academy of Sciences of Ukraine, who noted that «…problems of controlling

Conference Presidium (*from left to right*): I.K. Pokhodnya, academician of NASU, academician B.E. Paton and L.M. Lobanov, academician of NASU

the operating reliability and fatigue life of critical constructions by determination of their technical condition, residual life and establishing scientifically-grounded operating lives are now becoming particularly urgent». The integrated program of the NAS of Ukraine is aimed at solving exactly these problems. Its purpose is establishing methodological fundamentals, technical means and technologies for assessment and extension of the residual life of critical constructions in long-term operation. 26 institutes of eight divisions of the NAS of Ukraine were involved in fulfillment of this program, consisting of nine sections, including 118 projects. In the opinion of B.E. Paton, important scientific-technical and practical results were obtained during the three years. Among them are:

• development of the procedure for evaluation of strength and fatigue life of pipelines based on two-criteria fracture diagram in the presence of stress-corrosion defects with specifying of the admissible strength margin and proposed procedure of calculation of its real value;

• development of technologies of repair welding of steam turbine casing parts and high-pressure fittings for extension of service life of TPS turbounits;

• calculation by the criteria of fracture mechanics of admissible dimensions of crack-like defects in the walls of delivery pipelines of TPS supercritical pressure power units, depending on their shape and content of impurities in the operating environment;

• optimization of the technology of manufacturing low-frequency piezoceramic two-component accelerometers for vibration testing of NPP main circulating pumps in operation under the conditions of up to 300 °C temperatures. Test samples of accelerometers were made and their characteristics were studied;

• work on optimization of welding technologies and materials for reconditioning and extension of the life of operating bridges has been performed. A semiautomatic machine has been developed for reconditioning of underwater metal structures by arc welding to extend their service life;

• technology and equipment for diagnostics of structural elements from composite materials by laser interferometry methods have been developed and introduced in DB «Yuzhnoe»;

• samples of lamellar-combined fibrous composite materials have been developed and tested, forming the basis for development of explosion-proof chambers for safe cutting and treatment of metal structures;

• a test batch of enamel for petrochemical industry, using modified polyurethane paintwork materials for anti-corrosion coatings, has been made for petrochemical industry and pilot-production verification has been performed with its application on elements of equipment and pipelines of Lisichansk Petroleum Refinery;

• technology has been developed, which enables 3–4 times extension of operating life of drill bits for drilling wells in production of scattered or mine metal;

• it is established that long-term operation induces considerable changes of electrical properties of wall metal in the main pipelines. Correlation dependencies between the changes of mechanical and electrochemical properties were plotted, which open up possibilities for forecasting the operating reliability of pipeline metal.

Other important scientific-technical results have also been obtained during Program fulfillment. On the other hand, in the opinion of B.E. Paton, the Program contained a number of small projects, not having clear perspectives for application of the obtained results.

It is important to note that the Program scientific council ensured preparation of publishing of a final collection of scientific papers of projects of the Program «Problems of Life and Safe Operation of Structures, Construction and Machines» (Kiev: PWI, 2009, 710 pp.). The collection contains the main scientific and applied work results obtained during fulfillment of the Projects (the collection can be ordered from PWI by phone: 529-26-23).

After that the scientific leaders of Program Sections delivered their papers at the Conference.

V.I. Makhnenko, academician of the NAS of Ukraine, Scientific Leader of the Section «Development of procedural fundamentals of assessment of the technical condition and substantiation of safe life of structural elements of higher risk objects in the territory of Ukraine», in his presentation reported that all the six projects of this Program Section are related to critical objects such as steam generators (nuclear power engineering), main pipelines, railway transportation, apartment and industrial buildings in mine working areas. Important results have been obtained in all these fields.

Z.T. Nazarchuk, academician of the NAS of Ukraine, Scientific Leader of the Section «Development of the methods and new technical means of NDT and diagnostics of the state of materials and items in long-term operation», noted in his presentation that an effective monitoring system, new means of NDT of elements of a number of vitally important objects

have been developed, and new diagnostic equipment has been prepared for batch production.

V.I. Pokhmursky, Corresp. Member of the NAS of Ukraine, Scientific Leader of the Section «Development of the methods of corrosion protection of structural elements of objects in long-term operation», noted that the list of the most important results of the fulfilled projects should include development of a coating for improvement of operational reliability of pipes and boilers of electric power stations, development of coatings for protection from fretting corrosion, development of methods of corrosion protection of steel R-bars for extension of the residual life of concrete structures. He noted the importance of development of a state purpose-oriented program on corrosion protection of the structures of bridges and other objects in base sectors of the industry of Ukraine till as far as 2015.

Presentation on the Section «Development of effective methods of evaluation and extension of the service life of nuclear engineering facilities» (Scientific Leader is I.M. Neklyudov, academician of the NAS of Ukraine) was made by *V.N. Voevodin*, Dr. of Sci. (Eng.). He emphasized that most of the projects in this section have been fulfilled with the participation of Ukrainian NPPs. Analysis of the stress-strain state of WWER-1000 reactor cases, steam generators and welds of turbine section piping of power units in Zaporozhskaya and Yuzhno-Ukrainskaya NPP has been performed. The main causes for failure of pressure piping have been established, an expert procedure for their control by magnetic methods has been proposed.

B.S. Stogny, academician of the NAS of Ukraine, summing up the results of investigations on the Section «Improvement of reliability and extension of service life of power equipment and systems», noted that important results have been obtained, which will be used for improvement of reliability and extension of operating life of turbines, generators, equipment of gas pumping stations, as well as upgrading of boiler equipment of municipal power generation and coal-fired power units. Conducted studies allowed outlining and substantiating the main measures for extension of operating life of boiler equipment elements of load-area thermal power generation.

Scientific results obtained in the Section «Development of systems of monitoring of technical condition of pipelines and objects of gas and petroleum-processing industry» were reported by its Scientific Leader *A.Ya. Krasovsky*, Corresp. Member of the NAS of Ukraine. Among the most important achievements, he mentioned development of a computer system of ensuring the integrity of the main pipeline, development of an all-purpose algorithm for pressure calculation in pipeline system components, evaluation of structural strength of pipelines with defects.

Presentation by *L.M. Lobanov*, academician of the NAS of Ukraine, was devoted to the results obtained on 22 projects of the Section «Improvement of reliability and extension of the life of bridges, building, industrial and transport structures». Among them are development of the technology of repair welding of turbine casing parts, development of low-hydrogen electrodes for welding and repair of bridge and transport structures, etc.

Results obtained on the projects of the Section «Development of technologies of repair and reconditioning of structural elements of higher risk facilities in order to extend their operating life» (Scientific Leader is K.A. Yushchenko, academician of the NAS of Ukraine) were reported by *O.G. Kasatkin*, Dr. of Sci. (Eng.).

V.V. Panasyuk, academician of the NAS of Ukraine, Scientific Leader of Program Section «Preparation and publishing of normative documents and scientific-technical manuals on evaluation of the life of long-term operation objects», noted in his presentation that during 2007–2009 modern scientific-technical reference books have been prepared and published for engineering-technical staff of design and industrial enterprises for evaluation of the fatigue life and reliability (life) of elements of long-term operation structures, in particular bridge and building structures, thermal and nuclear power stations, pipelines, etc.

Conference session in progress

This was followed by discussion of scientific results set forth in the presentations of scientific leaders of Program Section. *V.I. Korol*, Dr. of Sci. (Eng.), Director of Donbass Center of Technological Safety, *P.I. Krivosheev*, Director of Building Structures RI, *A.I. Lantukh-Lyashchenko*, Professor of the Chair of Bridges and Tunnels of the National Transport University, *V.I. Bolshakov*, Director of Z.I. Nekrasov Iron and Steel Institute participated in the discussion.

All the presenters have noted the urgency and importance of the obtained results for solving the problem of life of long-term operation objects, expressed their opinion on the rationality of continuation of fulfillment of Program «Problems of Life and Operation of Structures, Constructions and Machines» in 2010–2012.

In conclusion, academician B.E. Paton said «...I believe that we have to support the proposal of the scientific council on extension of fulfillment of Program «Resurs» for the next three years. It is necessary to entrust the scientific council with defining new stages of work performance, focusing the scientific efforts on the most urgent directions of investigations, envisaging, primarily, practical application of the obtained results. I would like to particularly emphasize that during the competition primary attention should be given to funding of integrated major efforts, the without dispersing funds for small projects fulfillment».

In conclusion the resolutions of the Final Conference were approved.

Profs O.G. Kasatkin and V.N. Lipodaev, PWI

«FRONIUS» WELDING DEVICES FOUND APPLICATION IN MANUFACTURE OF ELECTRON BEAM REMELTING EQUIPMENT

Production base of International Company «Antares» relies on two electron beam vacuum furnaces VT01, each with an installed power of 2.5 MW and annual output of titanium equal to 2500 t. At present the Company is completing manufacture of a new generation of furnace VT02, which is an in-house development, featuring an installed power of 3.2 MW and annual titanium output of 3000 t. Design of the furnace will allow producing round ingots and slabs of titanium and its alloys with a weight of up to 14 t and length of up to 5.5 m.

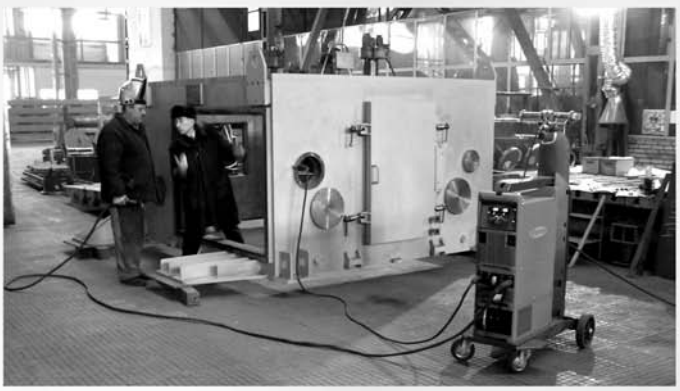


Photo in the cover page illustrates performance of welding of a melting chamber of furnace VT02 (steel 09G2S, lining of steel 10Kh18N10T) by using the welding equipment of the «Fronius» Company (Austria). IC «Antares» is currently using a range of the «Fronius» welding equipment, such as Magic Wave 2200, Magic Wave 5000 and Vario Star 457-2. Application of the above equipment allows «Antares» to improve economic indices of manufacture of assemblies of unit VT02 and provide the welded joints with high strength properties, and vacuum tightness of the welds in particular. Moreover, the Company achieved a substantial (up to 10 %) increase in productivity of welding operations, 5–5.5 % drop in consumption of welding wire, decrease in losses for its spattering, and reduction of costs for dressing of welds and removal of defects.

The Company managed to decrease residual stresses and strains and provide the preset accuracy of sizes and shapes of weldments due to decreased heat input and high reproducibility of welding parameters. This made it possible to reduce scopes of machining of vacuum flange connections.

Reduction of up to 15 % in operating costs was achieved in welding of conventional and stainless steels and copper owing to decrease in consumption of shielding gases, i.e. argon and helium.

As a result, robustness and failure-free operation of the «Fronius» welding equipment enables improving operating reliability of the electron beam units manufactured by IC «Antares».