The E.O. Paton Electric Welding Institute of the NAS of Ukraine was founded in 1934 by the prominent scientist and engineer Evgeny O. Paton. From the outset, the scientific activity of the Institute was based on the principle of combining fundamental research and applied engineering tasks. Scientists at the Institute successfully developed a method of automatic submerged-arc welding and elaboration of the scientific principles, technology and equipment for this process, which laid the basis for mechanisation and automation of welding production. The activity at the Institute featured expanding and deepening of theoretical and experimental investigations of welding different grades of steels, estimation of the strength of welded joints and structures and development of new systems of fluxes, wires and welding facilities.

In the 1950s the scientific activity of the Institute resulted in a wide application of automatic and semiautomatic welding in leading industries - ship building, tank, boiler and bridge construction, etc. A new method for joining heavy metal sections, i.e. "electroslag" welding, was developed on the basis of welding with forced weld formation. The technology of metal surfacing using alloyed solid and flux-cored wires was elaborated at that time for repair and manufacture of new products. Investigations were conducted to provide the technology for welding low-alloy and alloyed steels, aluminium, titanium and their alloys. The Institute was active in making new welding consumables, special equipment, power supplies and automatic control systems. A new technology for producing super high-quality metals and alloys, i.e. special electrometallurgy, emerged on the basis of using welding heat sources.

**FOCUS AND EXPERTISE**

Since 1953, Professor Boris E. Paton has headed the Institute of over 1500 specialists, which today is the world largest research and development centre on welding and special electrometallurgy. Scientists of the Institute accomplished many important milestones which include:

- Development of the technology for mechanised pulsed-arc welding,
- Welding in space and under water,
- Electron beam welding of thick metals,
- Flash-butt welding of heavy metal sections,
- New high-efficiency and low-toxicity welding consumables,
- Methods for substantial improvement of reliability and durability and extension of service life of welded structures,
- Methods and facilities for non-destructive testing and
- Technical diagnostics of welded joints and structures,
- Vapour-phase electron beam technology for production of materials with special properties,
- Electroslag re-melting and casting of parts,
- Widening of application fields for electric arc, including the plasma one, for welding, cutting, surfacing, coating and re-melting of metals.

Mathematical models and computer programs are available for prediction of thermal-deformation and solidification processes. Abnormal phenomena of gas absorption of metals under arc welding conditions have been studied. Currently the research priorities of the Institute are:

- Advanced welding technologies;
- Strength, reliability and durability of welded structures;
- Surfacing, coating and surface treatment technologies;
- Special electrometallurgy;
- Development of new structural and functional materials;
- Technical diagnostics and non-destructive testing;
- Automation of welding and related technologies.
PARTNERSHIP OPPORTUNITIES

ADVANCED PROTECTIVE COATINGS EQUIPMENT, MATERIALS, TECHNOLOGIES AND APPLICATION

**Microplasma Spraying**
- Microplasma spraying process
- Microplasma spray unit MPS-004

**Detonation Spraying**
- D-gun unit Perun-C

**Parts With Detonation Coatings**
- Rotors for the screw pump
- Inside part of the pump
- Different kind of axles
- DTool for drawing of copper wire

**Implants And Others Medical Items With Plasma Bio-ceramic Coatings**
- Hip implants with plasma bioceramic coatings
- Medical items with microplasma bioceramic coatings
- Parts with vanadium carbide wear-resistant coatings
Macrosection of the Cu-Ti tube-transition joint of a variable cross section made by explosion welding and simultaneous forming.

Ag-Cu bimetal magnetron target-cathode, made by explosion linear cladding, for the deposition of heat-insulating coatings on glass.

Steel hollow cylinders of an inside diameter 30 and 120 mm clad by explosion from an inside using a material with special service properties.

Aluminium-steel bimetal transition joint, made by precision explosion cladding, and used for EBW of electrolytic-cell anode.

Schematics (top) and virtual presentation of the real process of explosion welding (aluminium to steel) (right).

Overlap junction of 6-pairs of aluminium busbars and 3-pairs of aluminium taps of the current-conducting busbar made by shock-wave welding using single charge.

Precision explosion welding provides minimum consumption of an explosive and its efficiency factor, high reliability and safety of explosion operations. It permits solution of the problems being alternative-free for welding production.

Electrolytic-cell copper anode busbar explosion clad on two sides by an aluminium transition strips for further arc welding to flexible busbars.

Precision explosion welding is designed for producing welded joints of similar and dissimilar metals on the confined surface of the metal structure unit, thus meeting the required service properties of welded joints at the precision high-tech level.
Fabrication
of production, pilot production and laboratory equipment for deposition of coating by high-rate electron beam evaporation of materials in vacuum

Producing Coatings And Condensates

microlaminate structure porous structure

Application In Aircraft Systems
for producing thick structural coatings and repair of GTE blades

Production:
• targets of pure and multicomponent alloys (intermetallics, silicides, etc.)
• foils and some semi-finished products of shape-memory alloys (NiTi, etc.) coatings with quasicrystalline structure

dispersion-strengthened structure

for deposition of protective and thermal barrier coatings on GTE blades