



R&D IN WELDING OF PLASTICS

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R&D portfolio

- (1) Innovative technology and equipment for hot tool butt welding of polymeric pipes for water and gas supplying systems, as well as for sewage collectors (including vacuum sewage). (**Target market: construction**).
- (2) Innovative technology of seamless layer-to-layer welding of multilayered composite plastic pipes for hot water supplying and heating pipelines. (**Target market: construction**).
- (3) Resistance welding technology for units of high-technology plastics with contact surfaces with complex geometry (**Target markets: aerospace and automotive industry, ship-building**).
- (4) Immobilizing inflatable splints for temporary fixation of damaged human body for transporting from the place of accident to the place of **hospitalization** (**Target markets: military and emergency medicine**).
- (5) Technology of thermal impulse welding of thin woven polymer films and fabrics for manufacturing of fine filters (**Target markets: pharmacology, chemical, food and agricultural industries**).

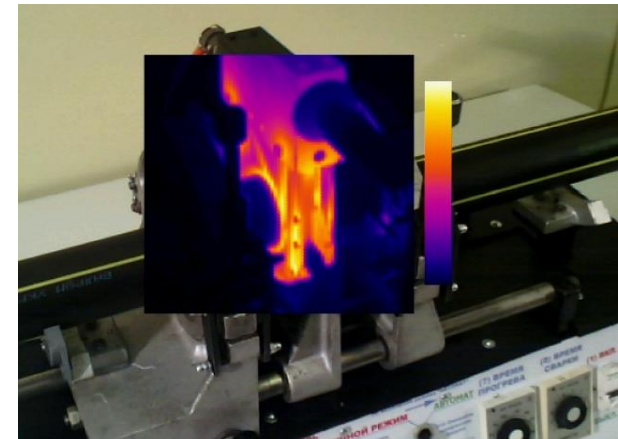
1

Innovative technology and equipment for hot tool butt welding of polymeric pipes for water and gas supplying systems, as well as for sewage collectors (including vacuum sewage)
(Target market: construction).

- **PROBLEM:** it is important for modern cities infrastructure to replace the metal pipelines with plastic ones, due to their serious advantages such like long operation time and lack of corrosion, cheaper pipes transporting and easier pipelines construction.
- **BRIEF DESCRIPTION:** Innovative technology and equipment allows to make hot tool butt welding in automatic mode (excluding human factor and hereby to improve the quality of welding), without preliminary mechanical treatment of pipes ends, and to form joints without internal rag; the welding device can be 60% cheaper comparing to the existing equipment from world brands, working by conventional hot tool butt welding scheme.



Laboratory equipment



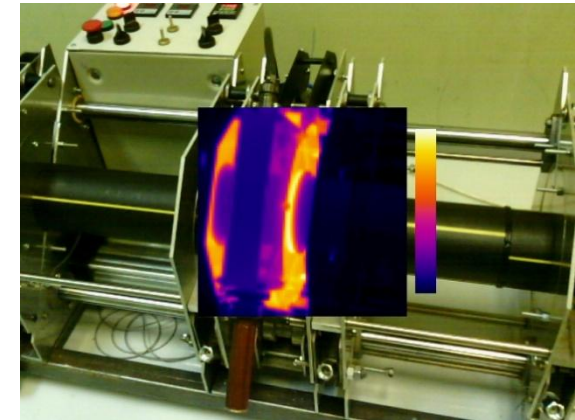
Innovative welding technology

1

Innovative technology and equipment for hot tool butt welding of polymeric pipes for water and gas supplying systems, as well as for sewage collectors (including vacuum sewage).

(Target market: construction).

- **DETAILS:** In this innovative technology one of the most time and labor-consuming operations of the hot tool butt welding process is excluded: mechanical facing of the pipes ends. The aim of such facing in the conventional technology is to make welded ends parallel, and to remove the layer of polymer, polluted or destructed under the affect of various factors. In this innovative technology the mechanical treatment is replaces with thermal facing, and this makes possible to refuse of the facing device which is up to 30% of weight and price of the welding device. This also makes possible to simplify the automation of the full cycle of the hot tool butt welding process, and hereby to exclude the human factor affect on the process, and thus to improve the quality of the welded joints.
- **PRACTICAL REALIZATION:** plastic pipes hot tool butt welding innovative technology is implemented in the laboratory and experiments equipment. Numerous test of the welding equipment and of the welded joints, both in laboratory and industrial conditions, have shown the high quality of the welded joints (not worse than of the joints welded according to the conventional scheme), but with considerable saving of the working time.



Pilot industrial equipment



Results of the complex testing

1

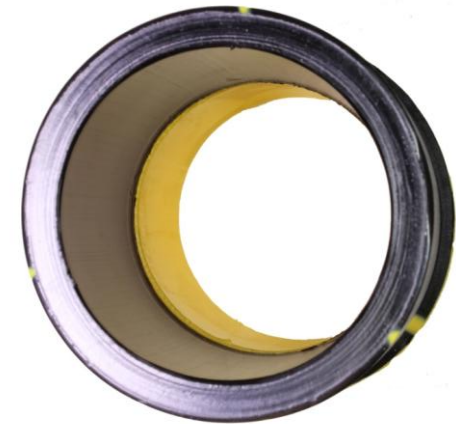
Innovative technology and equipment for hot tool butt welding of polymeric pipes for water and gas supplying systems, as well as for sewage collectors (including vacuum sewage).

(Target market: construction).

- Important advantage of the innovative technology and of the respective equipment is minimizing (up to complete disappearing) of the welding flash on the internal surface of the pipes, and replacement of the hydraulic system with the pneumatic one, with the same power as it is declared for the conventional equipment This also allows to reduce the weight of the innovative equipment up to 30%. If needed the pneumatic system can be easily changed back to the hydraulic one.
- Currently (within the process of preparing of the equipment production) technology of non-destructive testing of the welded joints produces according to the innovative technology is developed, with respective equipment for such testing.



A joint welded according to the conventional technology



A joint welded according to the innovative technology

1

Innovative technology and equipment for hot tool butt welding of polymeric pipes for water and gas supplying systems, as well as for sewage collectors (including vacuum sewage).

(Target market: construction).

- **Technical and economical advantages:**
- Considerable decreasing of the production expenses of the innovative equipment comparing to the conventional analogs; market price of the equipment can be on the level of the conventional equipment, and, respectively, can be more profitable.
- Design of the equipment makes it easy-to-transport in disassembled mode, and good maintainability.
- Technological advantages of the innovative equipment: easier automation, reduced weight, reduced flesh inside the pipe (or no flesh at all), simpler and quicker welding cycle.

- **Level of the development readiness:**
- IRL7, TRL6. Sales of the license with transfer of technical documentation for the production; in case of investments – launching of a facility for serial production.

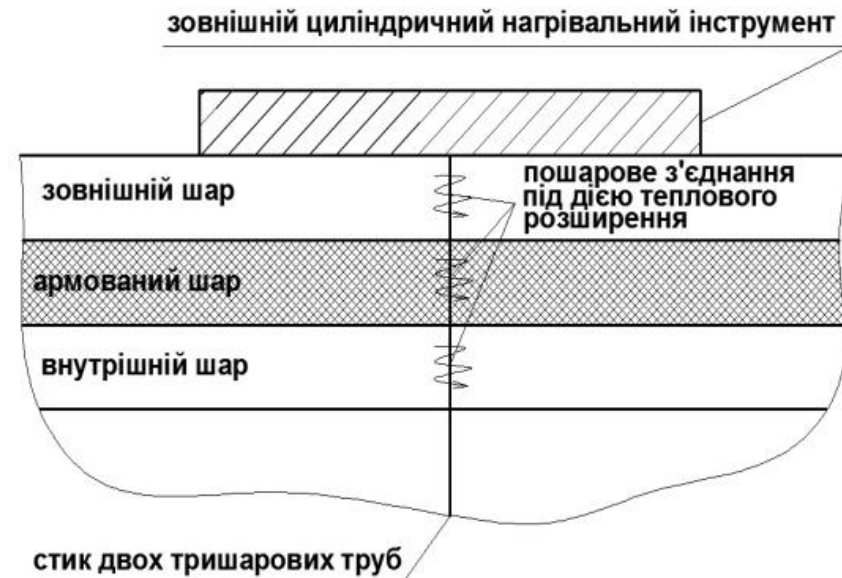
- **Level of the intellectual property protection:**
- IRP3 (Patent)

2

Innovative technology of seamless layer-to-layer welding of multilayered composite plastic pipes for hot water supplying and heating pipelines. (Target market: construction).

PROBLEM: Overlap and socket welding are normally used for the joining of multilayered polymeric composite pipes (widely used for hot-water supply and heating systems). Innovative technology makes possible to make butt welds without mandrels and sockets, thus reducing the operation expenses, but keeping the strength of the joints equal to the strength of the parent material.

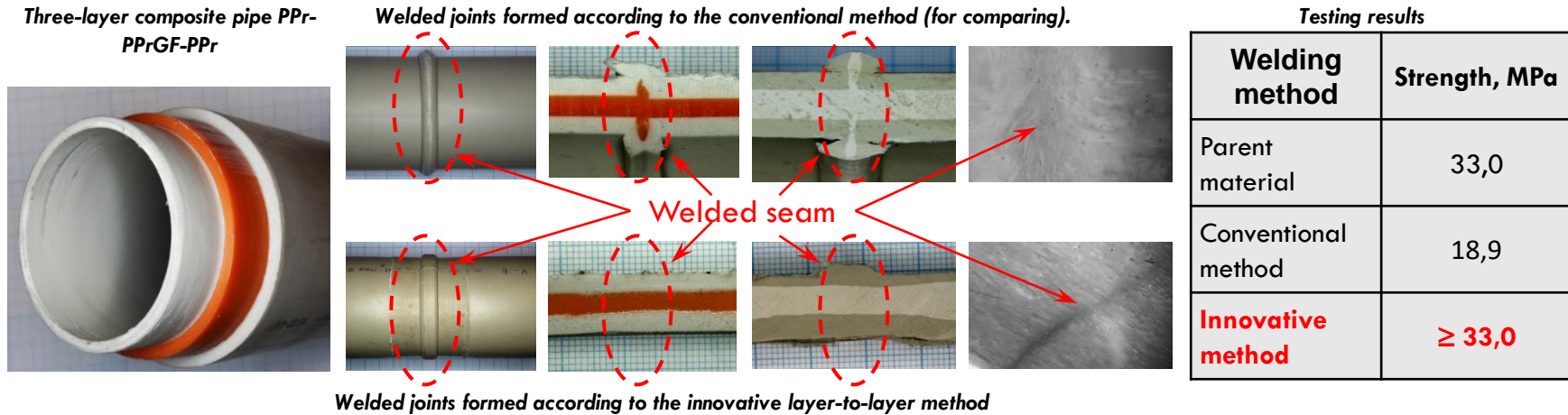
BRIEF DESCRIPTION: Technology implies the layer-to-layer welding of the polymeric composite pipes without flow and mixing of the material of the layers, and forming of the seamless joint due to the thermal extension of the polymer material of the layers.



Scheme of the innovative layer-to-layer welding of multilayered polymeric composite pipes

2

Innovative technology of seamless layer-to-layer welding of multilayered composite plastic pipes for hot water supplying and heating pipelines. (Target market: construction).

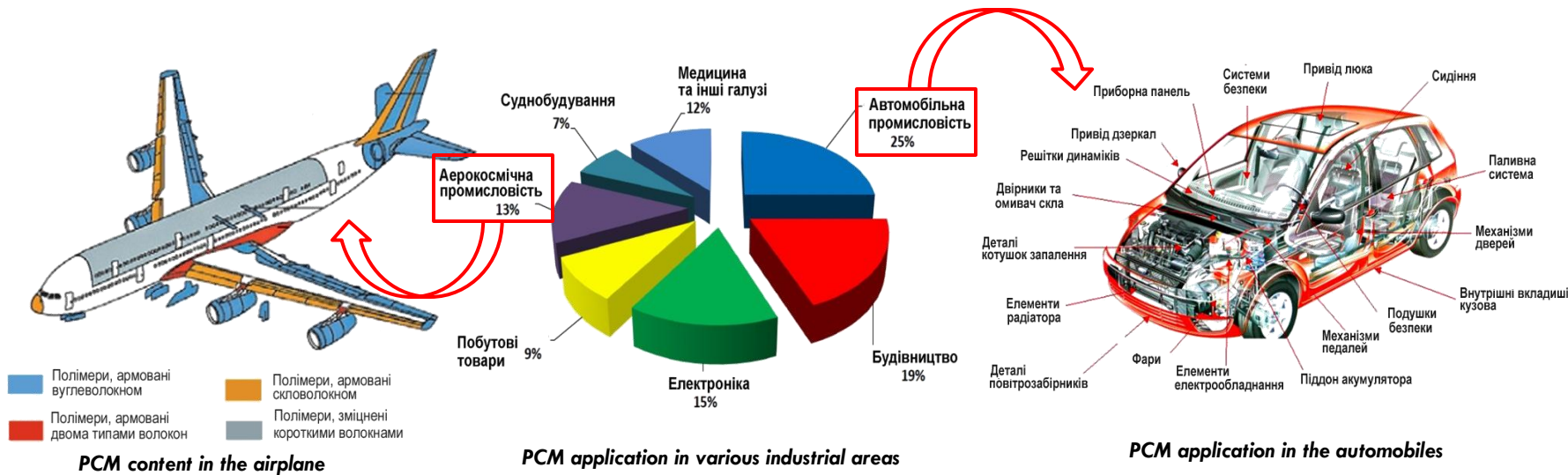


- **Technical and economical advantages**
- Innovative technology is implemented via additional equipment to the conventional polymer pipes hot tool butt welding device.
- **Level of the development readiness**
- IRL6, TRL5. Sales of the license with transfer of technical documentation for the production; in case of investments – launching of a facility for serial production.
- **Level of the intellectual property protection**
- IRP3 (Patent)

3

Resistance welding technology for units of high-technology plastics with contact surfaces with complex geometry (Target markets: aerospace and automotive industry, ship-building).

PROBLEM: With active development of technology areas of polymer materials application is permanently expanding, replacing metals and other commonly used materials. This allows to reduce weight, to improve operational characteristics, to decrease costs and labor intensity of production. Application of polymeric composite materials (PCM) based on the newest high-technology thermoplastic composites allows to improve operation characteristics considerably, what is extremely important for the high-technology industries.



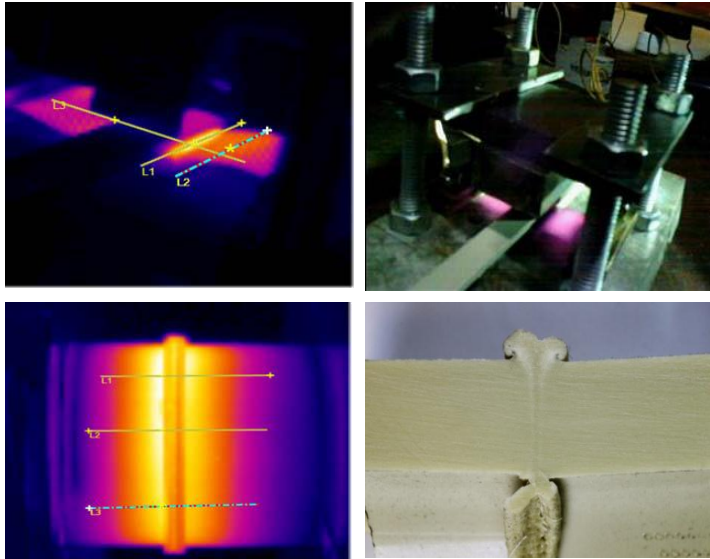
PCM are widely used in the aircraft-building industry for long time – for the outer coating and internal trimming, replacing thermoset materials with thermoplastics, which have much better technological, physical and chemical properties, as well as better welding ability.

In the automotive industry so-called under-hood details working at high temperatures, contacting with fuels, oils, as well as with coolants and other liquids are produced of PCM; these materials are also used for external and internal coatings, and for another supplementary details and units.

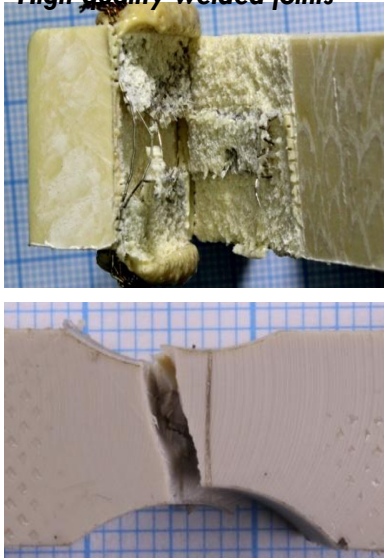
3

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(Target markets: aerospace and automotive industry, ship-building).

High-technology plastics welding processes



High-quality welded joints



Specimen of a T-welded joint with complex geometrical surface



- **Technical and economical advantages**
- Resistance welding technology is implemented due to the using of new types of resistant elements. This technology makes possible to weld units made of high-technology plastics with complex geometrical shape in one operation step.
- **Level of the development readiness**
- IRL5, TRL4. Production of equipment for particular tasks
- **Level of the intellectual property protection**
- IRP3 (Patent)

4

Immobilizing inflatable splints (IIS) for temporary fixation of damaged human body for transporting from the place of accident to the place of hospitalization
(Target markets: military and emergency medicine).

- Application area for IIS – temporary immobilizing of damaged parts of human body for transportation of the wounded man from the place of accident to the medical facility.
- Currently two types of IIS are developed, and pilot batches are produced for testing:
 - - IIS for temporary fixation of upper and lower limbs;
 - - IIS for temporary fixation of the human hip belt.
- Laboratory tests have been performed on the Traumatology and Orthopedics Cathedra of the National Medical University named after A.A. Bohomolets. Field tests have been carried out in the Training Center of the Armed Forces of Ukraine.



4

Immobilizing inflatable splints for temporary fixation of damaged human body for transporting from the place of accident to the place of hospitalization
(Target markets: military and emergency medicine).

- IIS approbation has been carried out in accordance to the Special Program “Military Medicine” on the platform of VI International Medical Forum ”Innovation in Medicine – Health of Nation” with the participation of prominent specialists in military medicine.
- Both versions of IIS are protected by patents; technological regulations are developed for the serial production; implementation certificates are received for the production of the test batches.
- In the future, in case of interest from respective parties, new types of IIS can be developed, i.e. for full body immobilizing (inflatable stretcher), or for immobilizing of various parts of the human body.



5

Technology of thermal impulse welding of thin woven polymer films and fabrics for manufacturing of fine filters
(Target markets: pharmacology, chemical, food and agricultural industries).

- **Technical and economical advantages**
- Thermal impulse welding technology of thin woven polymer films and fabrics is implemented via formation of the welded seam simultaneously with the cutting.
- Costs for the equipment implementing the developed technology are significantly lower comparing with the analogs.
- **Level of the development readiness.**
- IRL6, TRL5. Development of the equipment for particular solutions.
- **Level of the intellectual property protection**
- IRP3 (Patent)

