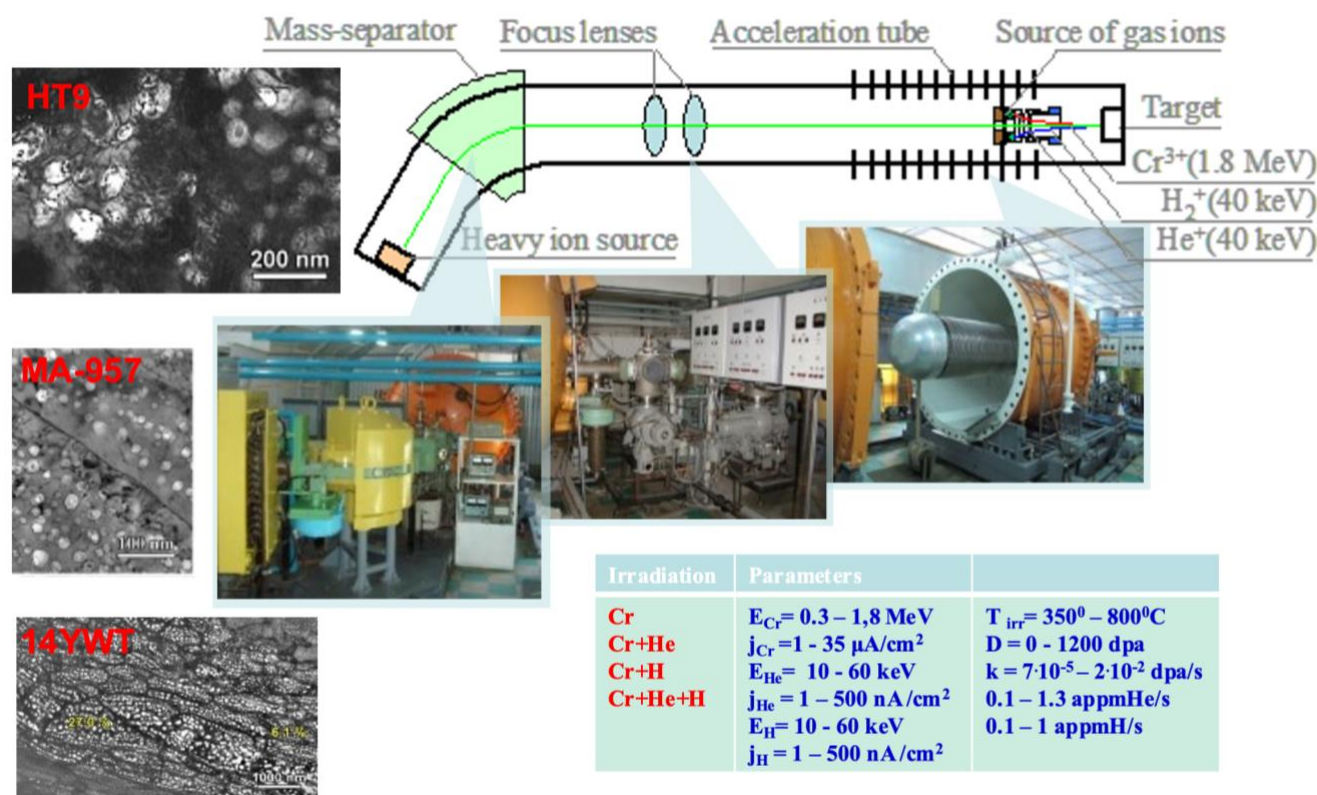


Before the war, one of the ISSPMT priority fields of research was the structural materials for operating nuclear reactors and solutions for NPPs lifetime extension. The obtained results contributed to the solution of the issue of the physical justification for extending the service life of these reactors. Other basic directions of research include the identification of the mechanism of changes in the physical and mechanical properties of materials and their dimensional stability under the influence of irradiation, the determination of the service life of structural elements of nuclear power plants, the selection and development of promising materials (austenitic and ferritic steels, zirconium and titanium alloys) for thermal and fast neutron reactors and electronuclear systems with enhanced radiation resistance.

For these studies, a special facility - an electrostatic accelerator with an external source of metal ions "ESUVI" - was used.

## Electrostatic Accelerator with External Injector (ESUVI)



Irradiations performed at the ESUVI accelerator were in demand by leading foreign experts (see publication list).

1. Atom probe tomography characterization of high-dose ion irradiated MA957 / Wang J., Toloczko M.B., Voyevodin V.N., Bryk V.V., Borodin O.V., Mel'nychenko V.V., Kalchenko A.S., Garner F.A., Shao L. // J. Nucl. Mater. 545 (2021) 152528 DOI: 10.1016/j.jnucmat.2020.152528
2. Use of double and triple-ion irradiation to study the influence of high levels of helium and hydrogen on void swelling of 8-12% Cr ferritic-martensitic steels / Kupriyanova, Y.E.; Bryk, V.V.; Borodin, O.V.; Kalchenko, A.S.; Voyevodin, V.N.; Tolstolutskaya, G.D.; Garner, F.A. // J. Nucl. Mater. 468 (2016) 264–273 DOI: 10.1016/j.jnucmat.2015.07.012

3. Ion-induced swelling of ODS ferritic alloy MA957 tubing to 500 dpa / Toloczko, M.B.; Garner, F.A.; Voyevodin, V.N.; Bryk, V.V.; Borodin, O.V.; Mel'Nychenko, V.V.; Kalchenko, A.S. // J. Nucl. Mater. 453 (2014) 323–333 DOI: 10.1016/j.jnucmat.2014.06.011
4. Synergistic effects of helium and hydrogen on self-ion-induced swelling of austenitic 18Cr10NiTi stainless steel / Borodin, O.V.; Bryk, V.V.; Kalchenko, A.S.; Melnichenko, V.V.; Voyevodin, V.N.; Garner, F.A. // J. Nucl. Mater. 442 (2013) S817–S820 DOI: 10.1016/j.jnucmat.2013.05.022
5. Prediction of swelling of 18Cr10NiTi austenitic steel over a wide range of displacement rates / Kalchenko, A.S.; Bryk, V.V.; Lazarev, N.P.; Neklyudov, I.M.; Voyevodin, V.N.; Garner, F.A. // J. Nucl. Mater. 399 (2010) 114–121 DOI: 10.1016/j.jnucmat.2010.01.010

As a result of hostilities (due to Russian aggression), the roof of the building and the premises with experimental installations were almost completely destroyed (Figs. 1). The main blow fell on an electrostatic accelerator "ESUVI". Non-stopped shelling of KIPT led to the destruction of several units of the accelerator (Figs. 2-4).



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

Figs. 1-4. Building and electrostatic accelerator with an external source of metal ions "ESUVI" after non-stopped shelling of KIPT.

**For the successful implementation of works on scientific and technical support for the safe and efficient operation and development of Ukrainian nuclear power plants, it is necessary to purchase a several units of the accelerator.**

- **Injection beamline** which includes ion source and other optical and diagnostic components leading up to the accelerator beamline. A beam current of at least 50  $\mu\text{A}$  is desirable for the metal ions (Fe, Cr, Ni).
- **Vacuum system** – includes fore- and high-vacuum pumps (three sets). Each set consists of turbomolecular high-vacuum pump, controller, cables, inlet screen, water cooling kit, vacuum valves, fore pump). In addition, it is advisable to purchase equipment for control and indication of the vacuum system status.

**The recovery of the electrostatic accelerator with an external source of metal ions "ESUVI" and improvement of its performance will contribute to solving important fundamental and applied problems in the field of radiation physics of structural materials.**