APPLIED ASPECTS OF THE NUCLEAR PHYSICS RESEARCH IN THE INP OF THE AS UZ AT LOW ENERGIES

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A number of the experimental techniques are developed and created for carrying out the nuclear physics research in INP AS UZ employing the major scientific facilities - WWR-SM nuclear reactor, accelerator U-150-II, the fast neutrons generator NG-150. These techniques are widely used in applied research.

At WWR-SM reactor, the applied research in the nuclear and radiation physics, material science, radiochemistry, activation analysis and nuclear medicine is successfully developed.

Core models for WWR-SM reactor (calculations of neutron physics, thermal hydraulic and kinetic parameters) are developed for operation with low enriched fuel. Changes of the electro-physical, thermal and mechanical properties of reactor materials are investigated at the irradiation by neutron flux with high fluence (~10^{22} n/cm^2).

The radiation technologies of natural mineral coloring (ennobling) for jewelry are put on industrial scale. Research on the production of radioactive nuclides with high specific activity, in particular ^{192}Ir, has been realized.

The special channel for neutron capture therapy (NCT) and medical-biologic applications is created at WWR-SM reactor. The neutron beam has sufficient epithermal neutron flux in an irradiation position at the minimal contribution of background radiation and provides the minimum irradiation dose outside of the beam. NCT method possibilities are tested on animals and on post-operating tumor material. Irradiation techniques, quantity and injection place of preparation, its accumulation and time of excretion from an organism are investigated together with other questions, including irradiation influence on biological tissue.

Unique non-destructive method for determination of the content and concentration profiles of lightest isotopes in various samples is exploited on the basis of the neutron generator NG-150. It is characterized by relatively large depth of the analysis. At that, the developed techniques of registration and ΔE-E identifications of recoiled nuclei are used. The method was applied for determination of content and distribution of deuterium and tritium in materials of the tokamaks first wall in the framework of ITER project, for testing of the reactor constructional materials, in research of diffusion processes of hydrogen isotopes in various materials.

The method to study the resistance of optical elements in the fast neutron field is developed which is important for creating the control and management tools of future thermonuclear reactors.

The method of neutron-activation analysis of light elements using fast neutrons is created on the base of the set-up for nuclear-astrophysical reactions study at very low energies. The method has convenient system of the automated data treatment, the high efficiency and sensitivity of the analysis. The method is used for the analysis of composition of food and agricultural production as well as to investigate coloring impurities in jewelry.