DESCRIPTION FOR GENERAL PUBLIC (IN ENGLISH)

The growing presence of ionizing radiation in all areas of life requires development of various measurement methods to ensure maximum radiation safety. Aside from industrial, scientific and energetic applications, ionizing radiation is increasingly present in medical diagnosis and cancer treatment. The project addresses the problem of dose measurement in a situation when the information about the dose or dose rate is immediately required even during the exposure to the radiation. Such a situation occurs for example when a patient undergoes radiotherapy treatment. Giving the appropriate dose of ionizing radiation in each radiotherapy session is evaluated three times: during therapy planning, phantom tests and during the actual radiation therapy session when the detector is placed on the patient's body in the place of radiation exposure. It is aimed to control the real dose delivered to the treated tissue volume in order to eliminate too low or too high doses. The measurement of dose on the patient's body (called *in-vivo*) is realized in real-time. It is possible due to the very small size of the detector (about $1mm^3$) connected by means of optical fibers with a device for stimulation and recording of the detector signal. A small piece of luminophore crystal can be a detector in this case. Luminophore is a material which during the irradiation is able to accumulate the information about the absorbed dose, and which during its excitation by light (in the case of optically stimulated luminescence, OSL) or temperature (thermoluminescence, TL) emits light whose intensity is proportional to the accumulated dose or which emits light spontaneously (radioluminescence, RL).

The project is aimed to develop a method for the measurement of the ionizing radiation doses in real time during exposure to the radiation using a detector based on luminescence crystals produced at IFJ PAN. Luminescence crystals are produced on the facility for crystal growth by micro-pulling down (MPD) method. This method enables receiving crystals in the shape of rodes of the diameter of 3mm and the length of some centimeters, which are next cut to smaller pieces. MPD is an ideal method for laboratory production of crystals on a small scale for the investigation of the influence of chemical composition and growth conditions on dosimetric properties.

Implementation of the project will involve optimization of luminescence crystals production for the detection of ionizing radiation and investigation of their properties in order to obtain the luminophores which will be characterized by good dosimetric properties: high signal generated by radiation, possibility to measure the spontaneous signal emitted during irradiation (RL) and possessing the ability to measure the signal after finishing the exposure to the radiation during light stimulation (OSL). Furthermore, a measuring system will be designed, consisting of a luminophore as a detector, optical fibers, photomultiplier for the signal recording and a system for stimulation: lasers and LEDs.

As the result of the project a dual – RL and OSL – method of the dose measurement in real time based on luminescence crystal produced at IFJ PAN will be developed.