9. DEPARTMENT OF RADIATION DETECTORS

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Overiew

Work carried out in 1997 in the Department of Radiation Detectors concentrated on three subjects: (i) Semiconductor Detectors (ii) X-ray Tube Generators (iii) Material Modification Using Ion and Plasma Beams.

SEMICONDUCTOR DETECTORS

Semiconductor detectors of ionizing radiation are among the basic tools utilized in such fields of research and industry as nuclear physics, high energy physics, medical (oncology) radiotherapy, radiological protection, environmental monitoring, energy dispersive X-ray fluorescence non-destructive analysis of chemical composition, nuclear power industry.

The Department all objectives are:

- search for new types of detectors
- adapting modern technologies (especially of industrial microelectronics) to detector manufacturing
- producing unique detectors tailored for physics experiments
- manufacturing standard detectors for radiation measuring instruments
- scientific development of the staff.

These 1997 objectives were accomplished particularly by:

- research on unique detectors for nuclear physics (e.g. transmission type Si(Li) detectors with extremely thin entrance and exit window)
- development of technology of high-resistivity (HRSi) silicon detectors and thermoelectric cooling systems (KBN grant)
- study of the applicability of industrial planar technology in producing detectors
- manufacturing detectors developed in previous years
- re-generating and servicing customer detectors of various origin.

In accomplishing of the above, the Department cooperated with interested groups of physicists from our Institute (P-I and P-II Departments), Warsaw University, Warsaw Heavy Ion Laboratory and with some technology Institutes based in Warsaw (ITME, ITE). Some detectors and services have been delivered to customers on a commercial basis.

X-RAY TUBE GENERATORS

The Department conducts research on design and technology of producing X-ray generators based on X-ray tubes of special construction. In 1997, work on a special design X-ray tube with "needle-like anode" for therapy of tumors begAn (KBN grant). In accomplishing the above, the Department cooperated with Polon IZOT and Dora Power Systems companies.

MATERIAL MODIFICATION USING ION AND PLASMA BEAMS

The technology of modifying surfaces of industrially used materials by means of continuous and pulsed energy beams has been intensely studied for more than 20 years. In some fields it is presently utilized on a broad scale in industry. A significant role among various methods is played by continuous or pulsed ion and plasma beams. The P-IX Department jointly with the P-V Department utilizes some unique sources of intense ion-plasma pulses. Experiments on conventional implantation of ions into engineering components are carried out in cooperation with FZ Rossendorf, (Germany), and ITME (Warsaw). Pioneering of new applications of the pulsed ion beams is thus possible. The processing step in the experiments conducted in cooperation with FZR is carried out in our Institute.

The main objectives of the Department in this field are:

- searching for new, original ways of modifying surface properties of solid materials by means of pulsed plasma beams
- implementation in the Institute and thus in the country of an ion implantation technique as a method of improving the quality of engineering tools.

These objectives were accomplished in 1997 particularly by:

- melting, and attempts of diffusive mixing, of selected metals with ceramic substrates by means of intense plasma pulses (proportion of ions of metal and of working gas varied in a controlled way)
- construction of the source of nitrogen ions
- improving the useful properties of selected machine tools by means of conventional ion implantation
- working-out some diagnostics for pulsed plasma beams (power vs time measurement)

In accomplishing the above the Department cooperated with the P-V Department, the Institute of Ion Beam Physics and Material Research (FZ Rossendorf, Germany), INCT (Warsaw), and ITME (Warsaw).