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Radiation processing of polymers and semiconductors by electron beam

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Electron beam treatment process has been successfully applied for modification of gas, liquid and solid phase of the matter. Radiation processing can be recognized as one of Advanced Oxidation Technology, where chemical, physical or biological transformations may occur when materials are exposed to high energy radiation (electron beam in particular case). The advantages of radiation processing are connected to the unique capability for material modifications, its high efficiency and possibility to transfer high amount of energy directly into the irradiated object. The first electron accelerator applied in the field of radiation chemistry and radiation processing was installed in Poland in 1971 when multipurpose facility was completed at the Institute of Nuclear Chemistry and Technology (INCT) in Warsaw. Since than nearly 30 electron accelerators have been installed in Poland as laboratory instruments, pilot plant installations and industrial facilities.

R&D studies in the field of radiation technology in Poland are mostly concentrated at the Institute of Nuclear Chemistry and Technology. The results INCT works on polymers and semiconductors modification have been implemented in various branches of national economy, particularly in industry and medicine starting from middle of 70-ties. Among others, the processes of irradiation and heat shrinkable products expansion were developed and transferred to the industry. The study on formulation of new PE composites better suited to new generation of heat shrinkable products, hot-melt adhesives, electrical wire and cables have been developed to meet specific requirements of customers. Modified polypropylene (PP-M) has been formulated at INCT to provide material suitable for medical application and radiation sterilization process.

Modification of the semiconductors devices by e-beam was applied on industrial scale since 1978 when INCT and LAMINA (semiconductor factory) successfully adopted that technology to improve quality of high power semiconductor devices. This activity is continued on commercial basis where INCT facility are being served as contract irradiation of certain semiconductor devices according to manufacturing program of LAMINA factory and customer from abroad.