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Ionizing Radiation - Innovative and Effective Tool for Science and Industry

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Ionizing radiations in the form of gamma rays, energetic electrons and X-rays (Bremsstrahlung) are being used for many practical applications. Successful irradiation processes provide significant advantages in comparison to typical thermal and chemical processes, such as higher throughput rates, reduced energy consumption, less environmental pollution, more precise process control and products with superior qualities. Ionizing radiation can modify the physical, chemical and biological properties of materials on an industrial scale. Many gamma sources and electron accelerators were built and installed for these purposes over the past fifty years and the field is still expanding. The biggest industrial use of ionizing radiation is the modification of polymer properties in a variety of industrial applications such as wire and cable insulation, tire manufacturing, production of polymeric foams, hydrogels and heat-shrinkable films and tubing, curing of coatings, adhesives and composites. Ionizing radiation became a perfect tool for formation and synthesis of nanoparticles and nanocomposites. Sterilization by ionizing radiation accounts for the preparation of approximately 50% of single use medical devices in UK and 40–50% of all disposable medical products in North America. Radiation technologies may also be applied to environmental protection and cultural heritage preservation. Efficient radiation technologies for gas, liquid and solid wastes treatment were developed to reduce environmental degradation. Cultural heritage artefacts based on paper, textiles or wood are prone to biological attack and their disinfection using ionizing radiation has been successfully demonstrated. Another field of applications is based on ionizing radiation penetration properties and its precise detection, through utilization of open and sealed radiation sources. Optimization of industrial processes is essential not only for efficient, safe and sustainable operation, but also to save materials, energy, protect the environment and reduce plant shutdown time. Complex industrial processes include environmentally related processes (such as harbours and dams, oil fields and ore/coal mines) so it is essential to have suitable means to investigate them for process optimization and trouble-shooting –preferably without shutting down the plant/process. Radiotracers and sealed source techniques are best-suited methods to address these problems. Nuclear techniques in most of the cases provide on-line investigations without shutting down the plant/process. Automation and improvements in instrumentation and hardware, such as tracer injection systems, detectors and data acquisition systems are developed for safer and reliable application. All applications are based on science developed in universities and research centres and then transferred to industry to be used in a safe and proper manner. It is a joint input of scientists and professionals working in the field to the main UN Millennium Goals of achieving a resource-efficient and climate-change-resilient economy and society, protecting and sustainably managing natural resources and ecosystems, and ensuring a sustainable supply and use of raw materials and other environmental resources. This universal humanistic role of science was articulated by Madame Curie, a lady born exactly 150 years ago in Warsaw as Maria Skłodowska. She developed a new innovative and effective tool –ionizing radiation, which broke new ground in physics and chemistry opening the door for advances in engineering, biology and medicine.

Country/Organization invited to participate

Poland

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