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Past, Present and Near Future of Radiation Processing of Polymers

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Past, present and near future of radiation processing of polymers

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In the early years of radiation processing, radiation-induced crosslinking of polymers and radiation sterilization of medical products have developed into substantial industries. Radiation processing of polymers in its widest sense is the application of radiochemical effects of ionizing radiations (Gamma rays, X-rays, Accelerated electrons and Swift heavy ions) on polymers and plastics on industrial scale. When polymers are irradiated with high energy radiation the ultimate effects are observed as crosslinking and/or scissioning of main or side chains, grafting, curing and formation of oxidized products. Among the established industrial applications of radiation processing of polymers; crosslinking of insulation of cables and wires, preparation of heat-shrinkables, polymer foams, automotive parts, tyres, water distribution pipes, tubes, plastic medical devices, hydrogel burn and wound dressings, composites, controlled degradation of teflon and marine-based cellulosics can be mentioned. The field of lignocellulosic fiber-polymer composites utilizing radiation technology in their formulation is re-emerging[1].

The applications mentioned above are based on radiation-induced control of structure formation in polymers on macroscopic scale, with the growing interest on development of nanomaterials based on polymers however, the unique role and power of ionizing radiation in nanostructuring have been rediscovered. Nanostructure formation by using ionizing radiation encompass a wide range of products namely, nanocomposites, nanogels, metallic nanoclusters, surface grafting at nanoscale, functionalization of track-etched membranes, molecular imprinting. This review will highlight chronologically the milestones of radiation processing of polymers in bulk, radiation-grafted materials for separation and purification[2], for energy conversion and energy storage[3] and health-care applications. Established and emerging applications of radiation technology for nanotechnology will be elaborated with a future outlook.

[1] O. Güven, S.N. Monterio, E.A.B. Moura, J.W. Drelich, "Re-emerging field of lignocellulosic fiber-polymer composites and Ionizing Radiation Technology in their formulation"Polymer Reviews, xx(2016)xxx.
[2] M.M. Nasef, O. Güven, "Radiation-grafted copolymers for separation and purification purposes: Status, challanges and future directions"Prog. Polym. Scien., 37(2012)1597-1606.
[3] M.M. Nasef, S.A. Gürsel, D. Karabelli, O. Güven, "Radiation-grafted materials for energy storage and energy conversion applications"Prog. Polym. Scien., xx(2016)xxx.

Country/Organization invited to participate

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