



TR0700113

Innovative Applications in Radiation Processing

D. A. Vroom

Consultant, Palo Alto Ca. 94303 USA

E-mail address of main author: david.vroom@sbcglobal.net

Prior to acquisition by Tyco International, Raychem Corporation initiated several programs to develop new products, reduce the production cost of existing products and identify new market areas that would utilize the skills available in the company in the area of radiation chemistry and radiation technology. Several areas were considered including radiation initiation of specific chemical reactions in polymers at high temperatures, the use of purpose built irradiation equipment for low cost production of specific high volume products and environmental remediation of ground or waste water. In this regard, the Corporation supported a program to improve how material is processed through an electron accelerator and to develop specific equipment to utilize these improvements. The goal was to make the radiation process a single entity as opposed to an accelerator and a material handling system. This paper discusses some of the developments from this program.

In the area of radiation induced chemical reactions in polymers at elevated temperatures, a robust accelerator was developed that would allow the irradiation of polymeric materials in the melt as they exited forming equipment such as plastics extruders. Here the goal was to have a low energy, self shielded accelerator in the 300 KeV to 500 KeV range in which extruded polymeric material could be immediately processed in a single pass at melt temperature before it was cooled and allowed to encounter any surfaces. Two machines that met these criteria were constructed and will be discussed. Several of the innovations coming from the high processing temperature, single pass accelerator project were incorporated into the development of purpose built machines to process specific existing products such as wire and heat shrink tubing. Here the goal was to have machines with the minimum acceptable electron energy and compact shielding to reduce cost and foot print. Beam scanning technology developed will be discussed.

A major program to look at applications of electron beam technology for environmental remediation was undertaken by Raychem Corporation from approximately 1992 to 1995. Early in the development cycle it was recognized that both low capital and operating costs would be the deciding factor for the viability of any processes developed. A project was initiated to develop a low cost, high power robust accelerator and liquids handling system that would operate automatically at remote locations and need little maintenance. Particular attention was paid to high electrical efficiency, high utilization of the electrons produced, simplicity of the high voltage generator and window life-time. The machine developed met the majority of the goals of the accelerator project. Basic design features will be presented. A parallel project investigating the chemistry of water remediation was also successful but pointed out the difficulties posed by small amounts of other chemical contaminants in the water that can influence the complex chemistry. The program was terminated because processing cost could never be reduced to a level where electron beam irradiation could successfully compete with demonstrated alternate water remediation technologies.