

The contribution of radiation chemistry to battery separator design: a review

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The concept of designing separators in terms of the base structure of the substrate with some form of surface chemistry modification has now become standard throughout the industry. It provides the foundation for the development of even more sophisticated separators for future applications including batteries for electric vehicles and for fuel cells.

This paper is a review of the development of speciality battery separators manufactured using radiation technology. Radiation grafted polyethylene film separators were introduced in the 1960's and became the industry standard for Zn/AgO cells. UV grafted non-woven polyolefin separators were first produced in the early 1990's to enhance the performance of NiCd cells. They also made a significant contribution to the successful commercialisation of NiMH cells which began around this time. Both the film and non-woven separators were developed to overcome specific problems affecting the performance of each of the battery systems.

Radiation chemistry employing an electron beam, gamma rays or UV radiation enables homopolymerisation, copolymerisation including graft copolymerisation, and cross-linking. This paper will explore how these different facets of the technology have been used to design separators with 'active' chemistry which directly influences the cell electrochemistry to extend shelf life and enable long term performance. In addition, the influence of separator chemistry on cell impedance and electrolyte management within the cell will be discussed.

Speciality battery separator manufacturers have continued to refine radiation technology in order to keep pace with the demands for batteries with increased power and longer life. Separator performance has played a significant role in the market growth of some electronic devices, for example, digital cameras. The contribution of separator design to the expansion of the battery market will be illustrated with particular reference to NiMH cells.