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Research Interests

Fuel Cell Design, Fuel Cell Reliability and Failure Modes, Accelerated Testing, Conductive Polymer Blends, Hydrogen Production and Distribution, Greener Energy System, Life Cycle Analysis, Hydrogen Hybrid System Design

My primary research interests are in the design and performance of *fuel cell stacks and systems*. Fuel cells are an emerging technology, and there will continue to be extensive research (especially applied research) over the next 20 years. At this stage in the development of fuel cells, long term test data is generally not available, or new designs are so radically advanced that previous data or experience are of limited use. Failure mode work that has been performed is generally preliminarily in nature, or not quantitative. Thus my primary interest is the modeling of fuel cell system reliability, and research into potential failure modes and causes experienced in fuel cells stacks. In order to adequately model fuel cell performance and reliability, I maintain an interest in both fuel cell modelling, as well reliability analysis and simulation.

Polymers will play essential roles in fuel cells as the electrolyte, gas diffusion layer, and bipolar plate materials. Therefore, the study of the reliability and failure modes in a fuel cell must include the development and testing of polymeric materials. Not only is the material section important, but the processes associated with the manufacture and assembly of membrane assembly electrodes (MEAs) and bipolar plates will have a large impact on fuel cell performance and reliability. The development and application of low cost conductive polymers is important in fuel cell and many other applications, and thus there is an interest in blending of polymers with carbon and other material for increased conductivity.

The interest in systems reliability analysis grew out of my experience in environmental management. I am very interested in the development and application of tools and techniques in order to evaluate and predict the impacts associated with industrial processes and products. The analysis techniques and stochastic principles involved in reliability analysis are very similar to the techniques use in environmental risk analysis. Thus, the broader fields of *industrial ecology* and *environmental risk management* continue to be of interest to me. Specifically I am interested in the improvement of environmental performance through the development and application of technology and management practice. Concurrent with this endeavour, I also think that it is important to demonstrate that good environmental performance is profitable and produces better products.

My two interests merge in that fuel cells represent a *green technology*, as they are presented as a vast improvement in environmental protection, specifically in their role to reduce carbon dioxide emissions. I hope to play a role in the development and implementation of *green power* generation systems. Application of environmental life cycle assessment is required with any new product in order to determine it's potential environmental impact. Reliability techniques are needed to understand the life cycle costs and performance characteristics of products. The fusion and application of these concepts are of research interest to me.