

XI.6 Dimensionally Stable High Performance Membrane (Phase I Project)

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Devices that employ fuel cell technology (such as vehicles, portable devices, and remote installations) require frequent startup/shutdown cycles. Many of these cycles occur at freezing temperatures that require the development of advanced membrane materials, which can be produced at reasonable cost while maintaining high performance. This project will develop a high performance membrane that will have excellent dimensional stability over a wide range of temperatures and relative humidity. A unique structure will alleviate the water/ice expansion problem during freeze/thaw process. The structure also will facilitate operation under low humidity and high temperatures, preventing shorting and enhancing the durability of the membrane. In Phase I, a base structure will be fabricated to prove the concept. The effects of pattern design, thickness, and fabrication process on performance will be evaluated. Comprehensive freeze/thaw (from -40°C to 100°C) cycling and full physical characterization will be conducted to evaluate structural stability and durability.