

Performance degradation of polymer electrolyte fuel cell (PEFC) undergoing freeze/thaw cycle

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The residual water in polymer electrolyte fuel cell (PEFC) systems may cause problems during the winter time. The objective of this work is to investigate physical damage to PEFC materials and electrochemical properties when subjected to freeze/thaw cycling. In the present approach two cells have been analyzed- the first cell suffered sub-zero temperature and the second cell (reference cell) experienced the room temperature and the two cells underwent the same number of temperature cycles. Significant damage to the MEA was observed after its use in freeze/thaw cycle. The post-operation analysis of the temperature cycled MEA was conducted to check any changes in physical properties. The performance degradation after freeze/thaw cycles has been found to be due to the physical destruction of electrode and its interface by the frozen water. The stiff GDL has been found to be better than the soft one for the catalyst layer. The characteristic changes in the properties of GDLs (felt and cloth type) have been investigated under sub-zero temperature and at the same freeze/thaw cycles. It has been observed that good contacts between the interfaces of materials can help in enhancing the durability of PEFCs in the sub-zero temperature conditions.