

Department of Chemistry, I.I.T Madras
Ph. D Seminar – II

Speaker : M. Helen (Roll No: CY03D017)

Venue : CB 310

Date : 28.01.2009

Time : 16:00 hrs

**Possibilities and Challenges in the Development of Membranes for
DMFC Applications**

Abstract:

The anxiety for alternate sources of energy has hastened the development of fuel cells. Though this technology is known for nearly over a century, the commercial viability of these devices has not been possible for want of technological developments concerning appropriate electrodes and also of cost effective membranes. In literature, there have been various attempts to develop alternate membranes to Nafion[®] (a monopoly product of Dupont). However these attempts have not been very successful due to the fact that it is nearly impossible to design a membrane that will have better ionic conductivity compared to Nafion[®], since Nafion[®] holds the utmost electronegative environment possible in a chemical system. Realizing this limitation, it was considered worthwhile to design a membrane which may possess ionic conductivity less than that of Nafion[®], but should have one property (for fuel cell applications) better than that of Nafion[®].

Since the fuel cross over from anode to the cathode in a fuel cell causes mixed potential at the cathode and hence affects the normally slow reaction of oxygen reduction, it was considered that the membrane development must look to this aspect of fuel cross over. However, to focus the issue more precisely the cross over of methanol (in the case of Direct Methanol Fuel Cells (DMFC)) is considered as the property of concern.

This presentation therefore focuses on the following aspects of this development:

1. If there are alternate membranes, which one of them is most appropriate for development at the current stage?
2. Having chosen the hybrid membranes as the appropriate ones, how does one incorporate the active components in the membrane?
3. What is the relative performance of the developed membrane with respect to that of Nafion[®] with respect to methanol cross-over?
4. Having realized that membrane development for fuel cell applications is still a challenging proposition, what is current feasible technology available to the monopolistic Nafion[®]?

It is realized that the problem on hand is most challenging, the solutions sought may not be the final answers but it is believed that they have at least provided some possible (if not appropriate) alternatives to carry the research forward in this field.

References:

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4. M. Helen, B. Viswanathan and S. Srinivasa Murthy, *J. Membr. Sci.*, **292** (2007) 98-105.
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