Florida State University

Innovative Proton Conducting Membranes for Fuel Cell Applications

PI: Ongi Englander **Co-PIs:** Anant Paravastu**,** Subramanian Ramakrishnian

Students Supported

Erin Holley (MS Materials Science, graduated August 2010)
Nicola Kissoon (MS Materials Science , to graduate Spring 2011
Velencia Witherspoon (BS Chemical Engineering (Honors Thesis), to graduate Spring 2011)

Description: This project was initiated in January 2009 as an interdisciplinary effort among Englander (Mechanical Engineering), Paravastu (Chemical and Biomedical Engineering) and Ramakrishnan (Chemical and Biomedical Engineering). The work was divided into two main tasks: (1) the fabrication and characterization of silica and latex-supported membranes, and (2) the incorporation of protein nanomaterials inside the silica membranes. Three female students have participated and contributed to the project (see below). Two of the students (Holley and Kissoon) have received/will receive MS degrees in Materials Science. Two of the students (Kissoon and Witherspoon) belong to underrepresented groups.

Budget: $30,000
University: FSU

Progress Summary

Project Impact and Conclusions:

Synthesis and Characterization of Latex Composite Membranes using monodisperse particles:
Particles of 200 nm, 650 nm and 900 nm were successfully synthesized using an emulsion polymerization technique. Membranes were then fabricated by depositing these particles on commercial supports and by heat stabilizing them.

Incorporation of protein nanomaterials inside silica membranes:
Physical incorporation of protein nanofibers into silica-based membranes requires the preparation of highly well-dispersed protein nanofiber arrays. Additionally, the functional integration of these materials with silica membranes requires that their electrical transport properties become better understood. Thus, our efforts have focused on both the synthesis of well-dispersed protein nanofibers and their integration with microfabricated electrodes as a means for the evaluation of electrical transport properties. We have successfully integrated well-dispersed protein nanofibers within the membranes, but have yet to realize a sample which is suitable for transport characterization studies.

Proposed Future Activities and their Potential Impact:
Develop methods and testing capabilities for characterizing the protein nanofibers within the membrane. For example, frequency-based transport measurements are needed as we suspect that ionic transport may play a significant role the overall transport characteristics in these materials.

Funds leveraged/new partnerships created

Faculty	University	Source/Agency	Project Title	Date Submitted	Amount
Englander, Paravastu	FAMU	MIT-HBCU program	Integration of Self Assembled Protein Nanofibers into Sensing Architectures	4/2010	$200K