The lack of economical and efficient energy storage technology is one of the major hurdles to the widespread utilization of the renewable solar and wind energy. The RFB is an attractive option for electric energy storage in the renewable power systems because of its excellent performance ion exchange polymer membranes are used in RFBs, but researchers are exploring alternative IEMs of new materials to improve its safety, high capacity, high efficiency, modularity, and small environmental footprint. Historically, research and development of IEM for RFB have been exclusively focused on ion exchange polymer membranes. Currently RFBs are not commercially competitive largely because of inefficiencies in the IEM which is a key factor determining its cost effectiveness, energy efficiency and battery lifetime.

Dr. Junhang Dong is a professor of Chemical Engineering. Dr. Dong's research focuses on the development of new types of ceramic ion exchange membranes for redox flow batteries (RFBs). His group is working on fundamental studies on molecular sieve ceramic membranes for controlled ion transport in electrolyte solutions. On the application side, these research projects aim to develop an enabling technology for electric energy storage in RFBs. Dr. Dong has recently received grants from the National Science Foundation Chemical, Bioengineering, Environmental, and Energy Research (CBET) and Small Business Innovation Research (SBIR) programs to perform these studies.

Dr. Dong's group is using materials with different mechanisms of ion transport and separation. The nanoporous ceramic electrolyte membranes being developed in Dr. Dong's group are fundamentally different from the conventional polymeric IEMs in terms of the material nature and mechanisms of ion transport. The solid oxide crystalline molecular sieves have a rigid framework, which makes them promising for proton transport. The performance of these membranes is characterized in an advanced materials characterization center.

The Advanced Materials Characterization Center (AMCC) is a research facility in the College of Engineering and Applied Science at UC. Research and development of new materials is performed at the center. The center provides advanced instrumentation, training and sample evaluation for the UC community as well as companies and other institutions. Research and development of new materials is performed at the center with the aim of finding new applications and solutions to various problems.

The microscopy instrumentation at the AMCC encompasses scanning electron (SEM), transmission electron (TEM), and atomic force (AFM) microscopes. Chemical analysis is done at the center by Energy Dispersive X-ray Spectroscopy (EDAX) and Time of Flight Secondary Ion Mass Spectroscopy (TOF SIMS). Mechanical Analysis plays a paramount role in materials characterization in the AMCC.

Structural Analysis is performed by X-Ray Diffraction (XRD), Particle Size Analysis and Dynamic Light Scattering (DLS). Research in multidisciplinary areas is performed with the help of the center. All issues of Research News from the Office of Graduate Studies and Research are available on the CEAS website: engrgrad@ucmail.uc.edu

Some of the images provided in the document include:

- FIG 1. SEM image of a butterfly wing collected for a DAAP project, while the SEM image of heart tissue is shown in Figure 2.
- FIG 3. SEM image of a fossil. The sample was sputtered with Gd and Pd for 60 seconds.
- FIG 4. TEM image of Al nanoparticles.

The microscopy images are provided to illustrate the research methods and characterization techniques used in Dr. Dong's group.

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