Battery Research at Fayetteville State University in the Context of Potential Global Warming

Prepared by Professor John Mattox, 12/5/08, http://astro.uncfsu.edu/mattox/

There is a scientific consensus on the fact that humanity's consumption of fossil fuels is causing the amount of carbon dioxide in the atmosphere to increase. It was measured to be 384 parts per million (ppm) in 2007, a 35% increase over the 284 ppm evident in 1832. It is now higher than it has been in at least a million years.

Although the effects of an elevated level of atmospheric carbon dioxide cannot be predicted with certainty, it is possible that it has caused the increase in global temperature that is now being observed. Furthermore, it is possible that this increase in temperature is resulting in more severe tropical storms, and changes in drought and storm patterns.

Further studies of the effects of increased atmospheric carbon dioxide are imperative. In addition, because of the potential severity of the consequences, it is appropriate that research also be done on renewable energy technology, i.e., useful energy sources that do not involve the release of carbon dioxide. This is a fundamental motivation for work recently initiated in FSU's Department of Natural Sciences.

Physicist John Mattox is collaborating with chemist Jonathan Breitzer to develop the FSU Center for Battery Research and Technology. Because many sources of renewable energy are intermittent, e.g., solar and wind power, the storage of energy in batteries is of interest to meet continuous demand with intermittent sources. Also, improvements in battery technology are crucial to the initiation of mass production of useful and affordable electric cars.

The efforts of the FSU Center for Battery Research and Technology will initially focus on the following goals:

1. Conducting and publishing fundamental research on battery chemistry and physics;
2. Participation in technological innovation to reduce the worldwide emission of carbon dioxide into the atmosphere through using energy more efficiently, and increasing the availability of renewable energy;
3. Spearheading innovative solutions to be implemented on the FSU campus that reduce CO_2 emissions and promote sustainability;
4. Providing a research experience for undergraduate students that begins early in their careers, as they learn the techniques and concepts from faculty and senior students, and culminates in a new project that they propose and execute; and,
5. Reaching out to the community to promote energy awareness, including field trips organized for local schools to visit the Center and conduct activities there.

The initial thrust of Mattox's battery work is to study aging mechanisms in high capacity lead-acid batteries, and to evaluate potential strategies to extend the life of these batteries. Six used golf-cart batteries from solar-powered homes in Western North Carolina were obtained in the summer of 2008 for this purpose. Professor Mattox has gathered unused equipment within the Department of Natural Sciences for this work and has built some specialized equipment (e.g., an automatic battery discharge controller). He is preparing initial results for publication, and is in contact with the manufacturer of these batteries. Mattox anticipates working with other battery chemistries also (e.g., lithium ion).

Professor Jonathan Breitzer is currently investigating the potential for carbon-sulphide battery technology. Carbon sulfides batteries are potentially an environmentally benign alternative to metal-based cathode materials in rechargeable batteries. Breitzer is also planning to contribute to the development of "green" manufacturing techniques for such materials.