Separation of Single-Walled Carbon Nanotubes with DEP-FFF

Simultaneous type and diameter separation of SWNTs is achieved by using flow injection dielectrophoresis.

Lyndon B. Johnson Space Center, Houston, Texas

In this study, a flow injection dielectrophoresis technique was used with a modified dielectrophoresis device. The length, width, and height of the modified chamber were 28, 2.5, and 0.025 cm, respectively. On the bottom of the chamber, there are two arrays of 50-µm-wide, 2-µm-thick gold electrodes, which are connected to an AC voltage generator and are alternately arranged so that every electrode is adjacent to two electrodes of the opposite polar. There is an additional plate electrode on the top of the chamber that is negatively biased.

During the experiment, a syringe pump constantly pumps in the mobile phase, 1-percent sodium dodecylbenzene sulfonate (SDBS) solution, into the chamber. The frequency and voltage are set to 1 MHz and 10 V peak-to-peak, respectively. About 150 µL of SWNTs in 1-percent SDBS decanted solution are injected to the mobile phase through a septum near the entrance of the chamber. The flow rate of the mobile phase is set to 0.02 cm³/min. The injected SWNTs sample flows through the chamber before it is lead into a fluorescence flow-through cell and collected for further analysis. The flow-through cell has three windows, thus allowing the fluorometer to collect fluorescence spectrum and visible absorption spectrums simultaneously.

Dielectrophoresis field-flow fractionation (DEP-FFF) generally depends on interaction of a sedimentation force and DEP force for particle separation, and SWNTs are neutrally buoyant in water. In this innovation, the third electrode was added to create a sedi-
mentation force based on DC electrophoresis. This makes this particular device applicable to separations on any neutrally buoyant particles in solution and a more general process for a broad range of nanomaterials sorting and separations.

This work was done by Howard K. Schmidt, Haiqing Peng, Noe Alvarez, Manuel Mendes, and Matteo Pasquali of Rice University for Johnson Space Center. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809.

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

Rice University
Office of Technology Transfer—MS 705
P.O. Box 1892
Houston, TX 77005
Phone No.: (713) 348-6188
E-mail: techtran@rice.edu
Refer to MSC-24368-1/70-1, volume and number of this NASA Tech Briefs issue, and the page number.

Li Anode Technology for Improved Performance

John H. Glenn Research Center, Cleveland, Ohio

A novel, low-cost approach to stabilization of Li metal anodes for high-performance rechargeable batteries was developed. Electrolyte additives are selected and used in Li cell electrolyte systems, promoting formation of a protective coating on Li metal anodes for improved cycle and safety performance.

Li batteries developed from the new system will show significantly improved battery performance characteristics, including energy/power density, cycle/calendar life, cost, and safety.

This work was done by Tuqiang Chen of TH Chem for Glenn Research Center. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steven Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18715-1.