

Purification of single-walled carbon nanotubes by means of an ultracentrifuge

CS-GXL series micro ultracentrifuge/S52ST swing rotor

The 1996 Nobel prize in Chemistry was awarded to Dr. Richard Errett Smalley for the finding of fullerene. The report¹ Dr. Richard Errett Smalley and his group members wrote in SCIENCE in July 2002 opened a new method of centrifugal separation and purification of carbon nanotubes (CNT). By using heavy water as a suspension liquid, multi-bundle CNT that was denser than heavy water was precipitated and single-bundle CNT that was less dense than heavy water remained in supernatant. Following is our advanced experiment report of sucrose density-gradient centrifugation in order to consider the possibility of finer separation according to difference in chirality etc.

Experiment

1. Conditions for centrifugation

Centrifuge: CS150GXL micro ultracentrifuge

Rotor: S52ST swing rotor

Tube: 5PA tube

Speed: 30,000 rpm

Maximum RCF: 92,000 x g

Time: 1 hour, 3 hours, 17 hours, and 34 hours

Temperature: 20°C

Density gradient solution: About 4.5 ml of 10 to 40 % (w/w) sucrose continuous density gradient solution (heavy water used)

Sample: About 0.5 ml of heavy-water suspension liquid containing SDS (1% of single-walled carbon nanotubes)

2. Result



Time:

1 hour

3 hours

17 hours

34 hours

3. Explanation

As the run time increases, the solution color becomes thinner due to dispersion and sedimentation of the black CNT particles. It suggests that CNT particles are separated according to size (sedimentation coefficient) or density. We consider that it is based on the difference in chirality etc.

There are many kinds of density gradient solutions other than sucrose. However, this kind of CNT sample generally contains relatively high-density surface-active agents such as SDS. Therefore, nonionic (nonelectrolyte) density gradient solutions are preferable to ionic density gradient solutions.

Reference

*1: Michael J. O'Connell, et al., Science, 297, 593-596 (2002)

Instruments



CS-GXL series micro ultracentrifuge



S52ST swing rotor

For more information, visit our website at:

<http://www.hitachi-koki.com/himac.contact/index.htm>

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