

Magnetic Field Effects on Fullerene Nanowhiskers

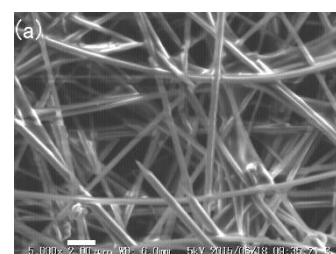
°Kazuki Kanei, Tetsuya Onotou and Isao Yamamoto (Yokohama Nat'l Univ.)

E-mail: kanei-kazuki-xp@ynu.jp

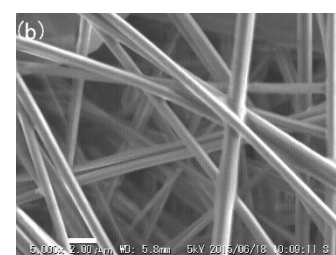
Fullerene nanowhiskers (FNWs) were discovered in 2001 and have been reported to be prepared by the liquid-liquid interfacial precipitation (LLIP) method [1]. In the LLIP method, a poor solvent is stacked on a saturated solution of a good solvent. Crystals are made and grown at the supersaturated interface caused by the mutual diffusion. We have prepared the FNWs by using the LLIP method under the strong magnetic fields. The control of the attitude and the size of FNWs was reported as a magnetic field effects. The FNWs are oriented perpendicular to the magnetic flux and the diameter increases under the horizontal magnetic field. These effects were determined in first six hours under the magnetic fields [2]. In this study, the magnetic field was applied in only the early stage of the reaction to consider the detailed mechanism.

In the experiment, toluene and isopropyl alcohol (IPA) were used as a good solvent and a poor solvent, respectively. The C_{60} fullerene saturated toluene solution of 1 ml was poured into a glass made reactor with an inner diameter of 14.5 mm. A small aluminum plate was fixed on the bottom to get the FNW precipitant to observe the SEM images. The IPA of 3 ml was stacked gently along a glass stick. After the growth reaction for 48 hours at 10°C, the reactor was taken from the magnet bore and the solution was removed by a pipet. The FNW products on the aluminum plate was dried naturally at R. T. and observed by SEM. The dependence of the period of the exposure to the magnetic field on the size of FNW was investigated.

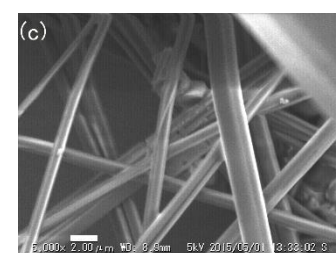
The SEM images of the FNWs were exemplified as shown in Fig.1. Each median of diameter is (a) 0.5 μm , (b) 0.8 μm and (c) 1.0 μm . It was recognized the diameter of the FNWs was increased with increasing time of the magnetic field exposure. As a result, the exposure to magnetic field in the initial stage of the growing reaction was thought to be important to enlarge the diameter of the FNWs.



(a) No magnetic field.



(b) Horizontal field of 9.6 T for 0-2.5h.



(c) Horizontal field of 9.6 T for 0-48h.

Fig.1 SEM images of FNWs. White bars indicate 2 μm .

References

- [1] K. Miyazawa, FULLERENE NANOWHISKERS, Pan Stanford Publishing, 235page, (2012).
- [2] T. Arashiro, R. Semba, R. Murase, S. Ozawa and I. Yamamoto, 61th JSAP Spring Meeting 20p-F4-4 (2014).