Magnetic Field Effect on Crystal Growth for NaCl by LLIP Method

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A crystal with a special shape is often prepared by liquid-liquid interface precipitation (LLIP) method. The interface between the poor solvent and the good solvent becomes supersaturated and then the seed crystals are yielded. The crystals grow at the supersaturation layer and the grown crystals precipitate in order to gravity. Fullerene nano-whiskers (FNWs) are a typical product by the LLIP and the magnetic field effects have been reported. The size was increased by 100 times under the strong magnetic field dependent on the magnetic flux density, its direction and the gradient[1, 2]. The control of crystalline morphology is very important in the fields of pharmaceutical, biomaterial, etc. In this study, the magnetic field effects on crystallization are investigated for NaCl by the LLIP under the influence of vertical magnetic fields.

A filter holder was used as a reactor. At first, 5.3 ml of saturated saline was put in it and 1.0 ml of 1-butanol was gently added to make the interface. The reactor was set in a bore of a vertical superconducting magnet and was taken from there after a few ten minutes of reaction time. Then the crystals and the solution were separated by filtration under reduced pressure. The crystals were dried naturally and observed by SEM. Their surfaces were dented stepwise as shown in Fig. 1. The two neighboring sides were measured for the two hundreds of the crystals and were evaluated by the histogram as shown in Fig. 2. The average area of the crystals prepared under microgravity decreased by a half compared to them under the hypergravity. The magnetic field effect is discussed with the magnetic torque, Lorentz force and Faraday force.

Fig. 1. SEM image of the concave step-wise NaCl crystals prepared by the LLIP method in zero magnetic fields after 50 minutes. The scale bar indicates 100 µm.

Fig. 2. Histograms of the areas of the NaCl crystals precipitated in the vertical magnetic field of \( B = 7.2 \, \text{T} \) after 50 minutes.