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Crystal Growth of NaCl by LLIP Method under Magnetic Fields Ⅲ

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Ⅰ. Introduction

Liquid-liquid interfacial precipitation (LLIP) method is a new crystallization technique, in which a poor solvent is stacked on a good solvent to form the liquid-liquid interface. Then, the solution becomes supersaturation at the interface, and the crystals were precipitated due to gravity. Kadota reported that some NaCl crystals made by LLIP method have the stepwise structure on the side of poor solvent. [1]

The effects of strong magnetic fields have been investigated for NaCl crystals made by LLIP method. The vertical maximum magnetic force field (MFF) and the vertical minimum MFF generate hypergravity and microgravity environment for the diamagnetic substances, respectively. We have reported that the small NaCl crystal was made under the vertical maximum MFF after the reaction period for an hour. But no effects was observed under vertical minimum MFF. In this study, we investigated the effects of minimum MFF on NaCl crystals after the reaction for more long time.

Ⅱ. Experiment

In the experiment, water and 1-butanol were used as a good solvent and a poor solvent respectively. 3 ml of 1-butamol was gently stacked on 2 ml of 26.2 wt% NaCl solution in the reactor. Then it was set in the bore of the 10 T superconducting magnet for 5 hours at 20 ℃. Crystal was grown under zero magnetic fields and the vertical minimum MFF ($B = 6.8\ \mathrm{T}, BdB/dz = -385\ \mathrm{T^2m^{-1}}$). The crystal growth behavior was observed by CCD camera in *situ*. Since NaCl crystal surfaces are formed square, short and long side length of the square were measured by using scanning electron microscope (SEM).

Ⅲ. Results & discussion

Fig. 1 shows the area histogram of NaCl crystals made in zero magnetic fields and the vertical minimum MFF. The area is calculated by the short and long side length of NaCl crystals. The bars in Fig. 1 indicate the frequency in each section divided at intervals of 0.05 mm^2. The frequency of crystal area over 0.10 mm^2 made in the vertical minimum MFF is larger than that in zero magnetic fields. NaCl crystals receive vertical upward faraday force under the vertical minimum MFF. We have considered this force causes staying NaCl crystals at liquid-liquid interface.

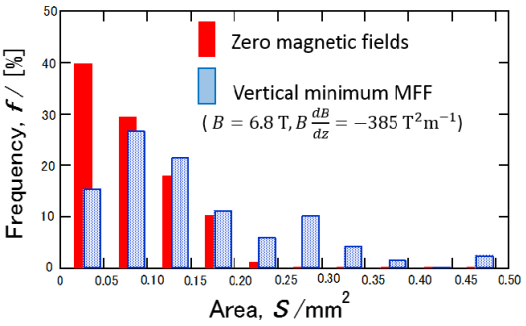

Fig. 1: Area histogram of NaCl crystals made by LLIP method in zero magnetic fields and the vertical minimum MFF.
($B = 6.8\ \mathrm{T}, BdB/dz = -385\ \mathrm{T^2m^{-1}}$)

References

[1] K. Kadota, S. Tanida, Y. Shirakawa, A. Shimosaka and J. Hidaka: Journal of Chemical Engineering of Japan, Vol. 40, No. 3, pp. 217-221, 2007.

[2] Ryusei Semba, Ryosuke Yoshida, Taku Arashiro, Shun Ozawa and Isao Yamamoto, the 62nd JSAP Spring Meeting, 2015, 14a-D11-7.