第76回応用物理学会秋季学術講演会 講演予稿集 (2015 名古屋国際会議場)

Control of Polymorphism of Glycine Crystal prepared by LLIP Method using Magnetic Field

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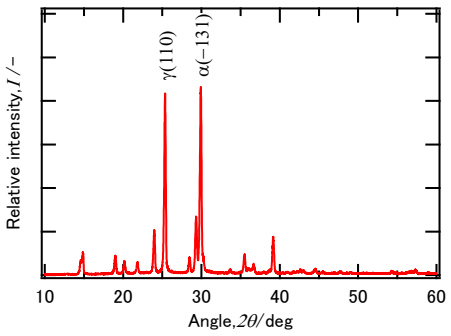
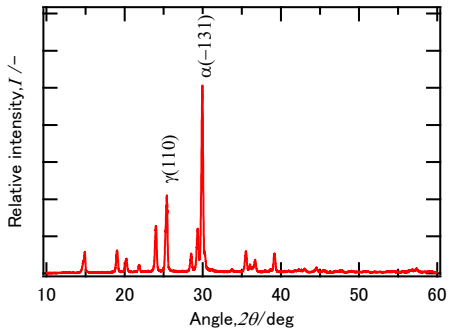
Recently, the remarkable magnetic field effects have been reported for the morphology of crystals prepared by the liquid-liquid interfacial precipitation (LLIP) method.[1] For example, the vertical magnetic field with gradient enlarges the volume of the C_{60} fullerene nano-fibers by 100 times.[2] The glycine amino acid is the most simple structure of all amino acid. The glycine has three types of crystal structure (α, β and γ), and these are different from the stability and the condition to precipitate. The α-glycine crystals are obtained when the water solution is cooled slowly. The β-glycine crystals are got when the ethanol is added into the glycine water solution. The γ-glycine crystals precipitate in the glycine water solution that is lower or higher than isoelectric point.[3] In addition, it is reported that the α-glycine crystals prepared by the evaporation process in the magnetic field was orientated and the growth rate was decreased.[4] We prepared the glycine crystal by the LLIP method in the magnetic field to investigate the magnetic field effect on polymorph.

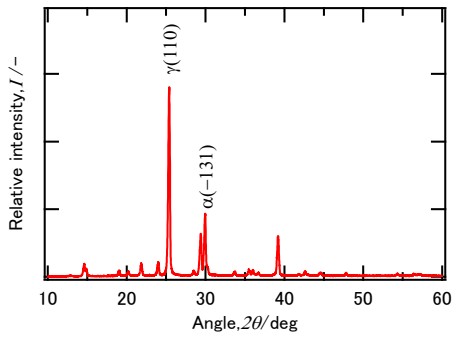
In experiment, the 2 mL of 1-propanol as poor solvent was put in a glass made reactor, and the 1 mL of the glycine saturated water solution as good solvent was added below calmly. The capped reactor were put in the bore of the superconducting magnet at 20℃. The homogeneous and gradient magnetic fields were applied vertically. After reaction for 22 hours, the reactor was taken out from the bore, and the liquid was removed from the reactor. The crystals were dried by the vacuum desiccator for 3 hours at room temperature. The crystals were analyzed by the powder X-ray diffraction. The XRD pattern was assigned to be the mixture of the α-glycine crystals (2θ = 30.06°) and the γ-glycine crystals (2θ = 25.35°). The α- and γ-glycine crystals were precipitated mainly under homogeneous and positive gradient magnetic fields, respectively. Consequently, the magnetic field influenced to the crystal polymorphism of the glycine.



(a) The gradient field of 6.8 T with -385 T^2m^{-1}.



(b) The homogeneous field of 9.6 T.



(c) The gradient field of 6.8 T with 385 T^2m^{-1}.

Fig. 1. XRD pattern for glycine crystal prepared by the LLIP method under the vertical magnetic fields.

[1] T. Arashiro *et al*, JSAP-MRS Joint Symposium, 20p-F4-4 (2014).
[2] I. Yamamoto *et al*, MRS-J symposium, J19-010 (2013).
[3] N. Nagashima, Journal of the Crystallographic Sosciety of Japan, 35 (1993) p. 381.
[4] M. Sueda *et al*, Science and Technology of Advanced Materials **7** (2006) pp. 380-384.