Magnetic Alignment of Hexagonal Boron Nitride and Its Magnetic Susceptibility II

Yokohama Nat'l Univ., Kotaro Nakada, Tomoyuki Katsumata, and Isao Yamamoto

E-mail: nakada-kotaro-km@ynu.jp

Hexagonal boron nitride (*h*-BN) is used widely in electric circuit base as insulator due to high thermal conductivity. The *h*-BN is disc shape with high anisotropies of thermal conductivity and magnetic susceptibility. Therefore magnetic alignment was studied to give high performance[1]. In this study, detailed magnetic behavior has been studied under various magnetic fields of up to 5 T at R. T.

The disk shaped powder with 10 μm diameter and 1 μm thickness in average was mixed within UV curable resin at the ratio of 10 wt.%. The composite was sandwiched to be a thickness of 160 μm by two slide glasses. The composite sample was set in the center of a superconducting magnet bore for a predetermined time. Then UV light was irradiated through the glass to fix the orientation structure. The orientation of *h*-BN was estimated by XRD pattern with CuKα. The peaks on $2\theta = 27$ and 42 deg were attributed to (002) of *c*-axis and (100) of *a*-axis of $P6_3/mmc$ structure, respectively [1]. When the surface of *h*-BN disk was perpendicular to the composite surface, (100) peak was increased and high thermal performance was expected. The degree of *a*-axix orientation α was estimated from the ratio between the two XRD peaks. The α was increased and saturated after a long time passed as shown in Fig. 1. When the high magnetic field was applied, the fast increasing rate, namely the short time constant, and the high saturated value were observed. Fig. 2 explained the magnetic field dependence of saturated degree of *a*-axis orientation. Anisotropic susceptibility $\Delta\chi$ of *h*-BN was evaluated from Fig. 2 [2]. Both the anisotropic susceptibility of *h*-BN were evaluated to be 4×10^{-7} emu/g.

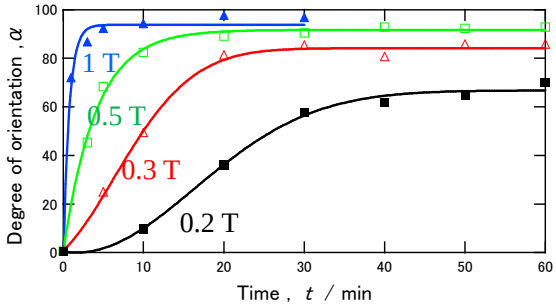

Fig. 1 Magnetic orientation behaviour of *a*-axis in vertical fields of 1T(▲) , 0.5 T(□) , 0.3 T(△) and 0.2 T(■).

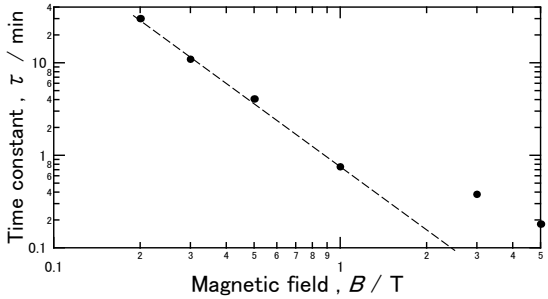

Fig. 2 Magnetic field dependence of time constant. The time constant was decreased in proportion to –2 power of the magnetic field.

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References: [1] H.B.Cho *et al*, Mater. Chem. Phys. 139 (2013) pp. 355-359. [2] A.Yamagishi *et al*, J. Phys. Soc. Jpn. 58/7 (1989) 2280-2283.