Magnetic alignment of hexagonal boron nitride and its magnetic susceptibility

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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 13 T at R. T.

The powder with 10 μm diameter and 1 μm thickness in average was mixed with UV curable resin with the ratio of 10 wt.%. The composite was sandwiched to be a thickness of 0.16 mm between two slide glasses. The composite sample was set in the center of superconducting magnet bore for a predetermined time. Then UV light was irradiated through the glass to maintain the orientation structure in the resin. The orientation of *h*-BN was estimated from XRD pattern with CuKα. The peaks on $2\theta =$ 27 and 42 degree 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, the (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 as a function of the exposure period as shown in Fig. 1. The α was increased and saturated after a long time passed. When the high magnetic field was applied, the fast increasing rate, namely the short time constant, and the high saturated value were observed. The inset of Fig. 1 explained the magnetic field dependence of saturated degree of *a*-axis orientation. Anisotropic susceptibility $\Delta\chi$ of *h*-BN was evaluated from the inset figure [2]. On the other hand, the time constant was decreased in proportion to –2 power of the magnetic field. Both the anisotropic susceptibility of *h*-BN were evaluated to be 2 ~ 5 $\times 10^{-7}$ emu/g.

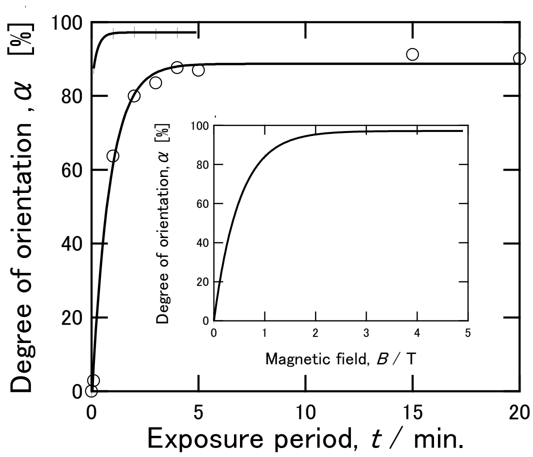

Fig. 1 Magnetic orientation behaviour of *a*-axis in vertical fields of 1T(○) and 5T(●). Inset showed orientation degree of *a*-axis as a function of magnetic flux density.

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