High-pressure synthesis of high purity single crystal of cubic and hexagonal boron nitride and their band-edge natures

***Takashi Taniguchi* and Kenji Watanabe,**

Advanced Materials Laboratory, *National Institute for Materials Science*

1-1Namiki Tsukuba Ibaraki 305-0044 Japan, TANIGUCHI.takashi@nims.go.jp

Cubic and hexagonal form of boron nitride(BN) single crystals were synthesized by using temperature gradient method under high pressure. Compounds of alkali metal and/or alkali earth metal- boron nitride were used as solvent for the crystal growth[1]. The quality of these single crystals was studied with respect to their optical properties , etch-pit density and SIMS analysis. Recovered crystals exhibited variety of colors and crystalline natures. Nearly colorless cubic BN crystals obtained by using Ba-BN solvent system revealed that superior characteristics showing optical properties of band-edge nature as well as lower etch-pit density of the order of 10^4/cm[1,2].

Furthermore, high quality single crystal of hexagonal BN were also grown by using Ba-BN solvent under HP/HT. The crystals exhibit the band-edge optical nature of direct wide-band gap semiconductor with Eg:5.9eV. Evidence for room temperature ultraviolet lasing at 215nm by accelerated electron excitation is provided by the enhancement and narrowing of the longitudinal mode, threshould behavior of the excitation current dependenceof the emission intensity, and a far-field pattern of the transverse mode[3,4].

References:

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