Synthesis of large-area hexagonal boron nitride films using chemical vapor deposition

Hamilton Victoria[1]、○Wang Shengnan[1]、鈴木 哲[1]、日比野 浩樹[1,2]、山本 秀樹[1]
(1. NTT 物性科学基礎研究所、2. 関西学院大学理工)
V. Hamilton[1], ◦S. Wang[1], S. Suzuki[1], H. Hibino[1,2], H. Yamanoto[1]
(1. NTT Basic Research Labs., 2. Kwansei Gakuin Univ.)
E-mail: wang.shengnan@lab.ntt.co.jp

Hexagonal boron nitride (h-BN), a structural analogue of graphene, is an electrical insulator with a wide bandgap (5.9 eV).[1] It has an inert and atomically smooth surface, which is free of dangling bonds and charged impurities, making it an ideal dielectric material for graphene and transition metal dichalcogenides based electronics and optoelectronics. Thus, the growth of h-BN is of much interest for scalable two dimensional materials related applications.

In this study, we performed the low pressure chemical vapor deposition (LPCVD) growth of h-BN on a copper foil using ammonia borane as precursor. Figure 1 shows a schematic of CVD setup with individually controlled temperature zones for precursor and catalyst. We found that the domain size and density of h-BN, as well as coverage, is highly dependent on the copper foil position along the carrier gas flow. The size of the as-grown triangle h-BN domains gradually enlarges as the catalyst position moves away from the precursor. The influence of other growth parameters, such as precursor and catalyst temperature, precursor amount, and deposition time, were also systematically investigated to understand the h-BN growth on Cu catalyst under LPCVD condition.

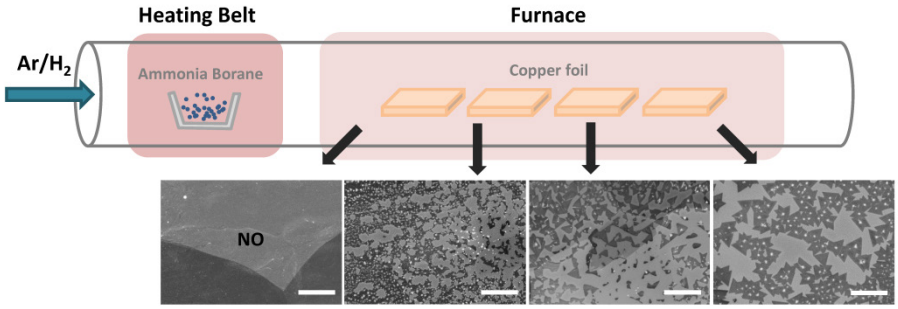

Figure 1 Schematic of h-BN CVD setup and SEM images of as-grown h-BN films on the copper foils at different locations. The temperature of precursor and catalyst is 85 and 1000 °C, respectively. The scale bar is 5 μm.

References:

[1] K. Watanabe et al. Nat. Mater., 2004, 3, 404-409.