ホウ素と硫黄を用いた新規二次元物質の合成

New two-dimensional materials synthesized by using boron and sulfur

筑波大[1]，東工大[2]，名古屋大[3]，高知工科大[4]，NIMS[5]，KEK[6]　○日下 陽貴[1]，石引 涼太[1]，豊田 雅之[2]，徳永 智春[3]，藤田 武志[4]，宮川 仁[5]，西堀 英治[1]，松下 恭介[5]，増田 卓也[5]，堀場 弘司[6]，齋藤 晋[2]，渡邊 賢司[5]，谷口 尚[5]，細野 秀雄[2]，近藤 剛弘[1,2]

Univ. Tsukuba[1], Tokyo Tech.[2], Nagoya Univ.[3], Kouchi Uni. Tech.[4], NIMS[5], KEK[6], ○Haruki Kusaka[1], Ryota Ishibiki[2], Masayuki Toyoda[2], Tomoharu Tokunaga[3], Takeshi Fujita[4], Masashi Miyakawa[2], Eiji Nishibori[1], Kyosuke Matsushita[5], Takuya Masuda[5], Koji Horiba[6], Susumu Saito[2], Kenji Watanabe[5], Takashi Taniguchi[5], Hideo Hosono[2], Takahiro Kondo[1,2]

E-mail: s1610981@s.tsukuba.ac.jp

Two-dimensional (2D) materials consisting of a single or a few layers of atoms have superior performance as compared to conventional materials or their bulk counterparts in a variety of applications, because of their unique properties, including their flexibility, high specific surface area, and quasi-2D electron confinement. Combining 2D materials through layer stacking in a controlled manner can also produce several novel functionalities in the form of new three-dimensional (3D) layered materials (van der Waals heterostructures) [1]. Therefore, synthesis of new 2D materials opens several pathways for the applied use of van der Waals heterostructures.

In this work, we have synthesized rhombohedral boron monosulfide (r-BS) based on the procedure reported in literature [2], where r-BS was reported to be synthesized above 1473 K under high pressure condition (3-7 GPa). We have then exfoliated the synthesized r-BS to form a new two-dimensional material of boron monosulfide (BS). In the presentation, we will report on the results of X-ray diffraction, X-ray photoelectron spectroscopy, transmission electron microscopy (TEM), atomic force microscopy, Raman spectroscopy, and photo luminescence as well as the theoretical calculation results. These results suggests the successful exfoliation of BS sheets from bulk r-BS. Fig. 1-left shows typical TEM image of BS sheets with a few layer thickness, where the corresponding diffraction pattern (Fig. 1-right) clearly indicates the crystalline structure of BS.

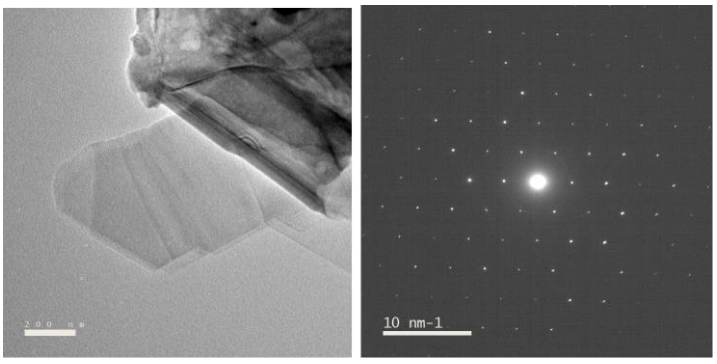

Fig. 1 Typical TEM image of synthesized BS sheets (left). The corresponding diffraction pattern obtained during TEM observation.

[1] A. K. Geim & I. V. Grigorieva, *Nature*, **499**, 419 (2013).

[2] T. Sasaki, H. Takizawa, K. Uheda, and T. Endo, *Phys. Stat. Sol.* **223**, 29 (2001).