STM investigation of Bi thin films on WSe2: Growth and structural changes with film thickness

Sangsoo Lee
Jeongseok Woo, Geunseop Lee
Inha University, Incheon 22212, Korea
glee@inha.ac.kr

WSe_2 is one of the transitional metal dichalcogenides (TMDS) materials whose layers are coupled by van der waals interaction. Since there are no dangling bonds and little defects on the surface, it can serve a good substrate material to grow metal films [1]. Bismuth (Bi), one of the major components of topological insulators (TIs), is known to possess a nontrivial property when prepared as a very thin film [2-4]. In this study, we grew Bi thin films on a WSe_2 surface exfoliated in an ultra-high vacuum chamber and investigated the atomic structures of the Bi films using a scanning tunneling microscope (STM). At room temperature, Bi islands grow in the Volmer-Weber type of growth, i.e., they grow vertically and forms islands with different thicknesses before the WSe_2 substrate surface is entirely covered by deposited Bi atoms. Therefore, Bi islands with several different layer thicknesses coexist with the bare, uncovered WSe_2 surface. In Bi islands with thicknesses of 2-8 monolayers (MLs), Bi atoms arrange to form a rectangular lattice structure that is close to a Bi(110) surface. In Bi islands thicker than 8 ML, a Bi(111)-like surface with a hexagonal lattice forms. The topological properties related to the Bi thin films grown on WSe_2 with different atomic structures and film thicknesses will be discussed through comparison with Bi thin films grown on the surfaces of other materials.

References

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[2] Y. Lu et al., Nano Lett. 15 (2015) 80
[3] F. Reis et al., Science 357 (2017) 287
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Figures

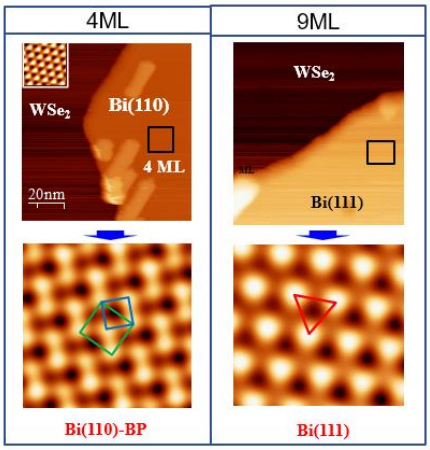

Figure 1: Insert caption to place caption below figure (Century Gothic 10)