Sputtering Deposition of Antimonene Film

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Antimony (Sb), in the same column of phosphorous in the element table, has a layered crystalline structure. A monolayer of antimony, named as antimonene, is predicted to be a stable semiconductor with a high mobility, and it becomes a semimetal when the thickness increases to bilayer or thicker [1,2]. These properties make antimonene flakes promising for nano-electronic devices and electrochemical applications. In the recent reports, antimonene thin flakes have been prepared by either exfoliation or molecular beam epitaxy [3,4]. However, these flakes are usually so small (less than 1 micrometre) that it is difficult to fabricate devices based on these flakes. The preparation of large size antimonene thin flakes is still challenging. In this work, we explored the deposition of few-layer Sb nanofilms with low-power magnetron sputtering and studied the electrical properties of the deposited films. We found that, with in-situ annealing, the crystalline structure can be greatly improved, and the conductivity much increased. Oxygen evolution reaction (OER) and hydrogen evolution reaction tests also confirm the improved performance of the Sb film deposited at high temperature.

Keywords: antimonene, sputtering deposition, 2D materials, OER, HER

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FIGURES

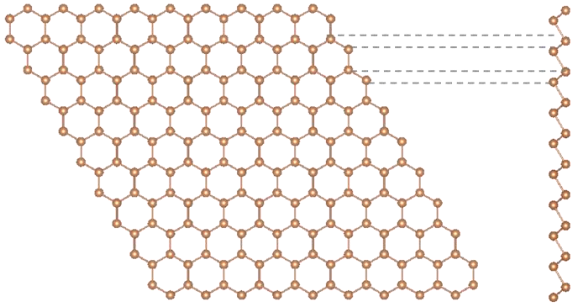

Figure 1: Crystalline structure of antimonene monolayer from top view (left) and side view (right).

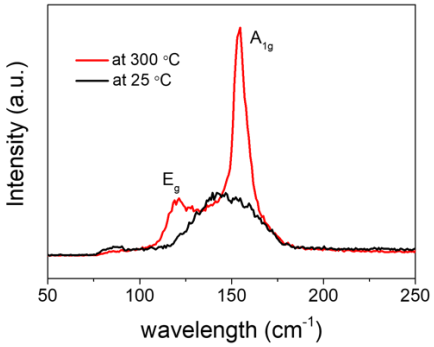

Figure 2: Raman characterization of Sb films deposited at different temperatures. The one deposited at high temperature shows better crystalline structure.