Observation of Electronic States in Sb-doped $ZrTe_5$

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The topological character of zirconium pentatelluride ($ZrTe_5$) has triggered new studies to understand the origin of its properties through the band structure of its surface [1]. Studies in the past years have succeeded in proving some of the exotic properties of $ZrTe_5$ through electrical resistance, magnetic susceptibility [2,3] and band structure [4]. Unfortunately, unanimous consensus on band structure versus temperature results has not been reached so that evidence generated from direct experiments to support this theory is still lacking which necessitates the development of further research. Previous investigations of the band structure have revealed a shift of the band towards binding energies in temperature with the range of 125-300 Kelvin [5]. Since $ZrTe_5$ doped with antimony (Sb) is still lacking, we focused on investigating the new structure of $ZrTe_5$ doped with Sb. It is expected that a band shift will be formed from $ZrTe_5$ with Sb doping. In this study, we measured Sb-doped $ZrTe_5$ and observed the surface electronic state using angle-resolved photoemission spectroscopy (ARPES). In this study, we provide information on the band structure of non-doped $ZrTe_5$ and Sb-doped $ZrTe_5$ with variations in photon energy and temperature. Photon energy variations include 66 electronvolt to 75 electronvolt. Meanwhile, temperature variations are in the range of 20 Kelvin to 100 Kelvin for non-doped $ZrTe_5$ and 8 Kelvin to 45 Kelvin for Sb-doped $ZrTe_5$. This study also provides a comparison of the momentum distribution curve and energy distribution curve to prove the temperature dependence of non-doped $ZrTe_5$ and Sb-doped $ZrTe_5$.

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