

PCP2-4

Observation of surface structure in Hf doped ZrTe₃ by STM

*Sora Kobayashi¹, Shun Ohta¹, Satoshi Demura², Atsushi Nomura¹, Hideaki Sakata¹

Department of Physics, Tokyo University of Science, Japan¹
College of Science and Technology, Nihon University, Japan²

In transition metal trichalcogenide ZrTe₃, one dimensional charge density wave (CDW), which have the wave vector $q_{CDW} \cong (0.07, 0, 0.333)$ appears along the a-axis at about 63K, and filamentary superconductivity appears at 2K [1]. STM measurements at 4.2K in ZrTe₃ have revealed not only the CDW but also black streaks extending along the a-axis. The number of the streaks was found to increase when ZrTe₃ was grown at high temperature [2]. Since changes in physical properties due to crystal growth temperature has been reported in ZrTe₃[3], the streaks seems to greatly affect the physical properties in this material.

Transition metal trichalcogenide HfTe₃ also exhibits quasi-one-dimensional properties. In HfTe₃, it has been reported that a one-dimensional CDW along the a-axis at about 82K and superconductivity appears at about 1.4K [4,5]. However, in HfTe₃, the details of the CDW or existence of the streaks observed in ZrTe₃ have not been reported. This seems to be due to the fact that HfTe₃ is unstable against humidity in atmosphere unlike ZrTe₃.

In this study, the sample Hf_xZr_{1-x}Te₃, in which the Zr site of ZrTe₃ is partially substituted for Hf, was synthesized and STM observations were performed to observe the existence of the streaks and change in the CDW due to Hf substitution. Electrical resistivity measurements showed that the CDW transition temperature increased with Hf substitution. STM observations at 4.2K revealed the existence of the similar streak to those observed in ZrTe₃. Furthermore, in addition to the CDW inherent to ZrTe₃, additional harmonic-like structure was observed. In this presentation, we will discuss the details of the change in STM images due to Hf substitution on the Zr site of ZrTe₃.

[1] D.J. Eaglesham et al., Journal of Physics C: Solid State Physics 17 (1984) L697

[2] S. Kobayashi et al, The Annual Meeting of JPSJ 2019 (Tokyo univ of science)

[3] X. Zhu et al., PHYSICAL REVIEW B 87, 024508 (2013)

[4] Jing Li et al., PHYSICAL REVIEW B 96, 174510 (2017)

[5] S. J. Denholme et al., Scientific Report 7, 45217 (2017)

Keywords: HfxZr1-xTe3, ZrTe3, CDW, STM