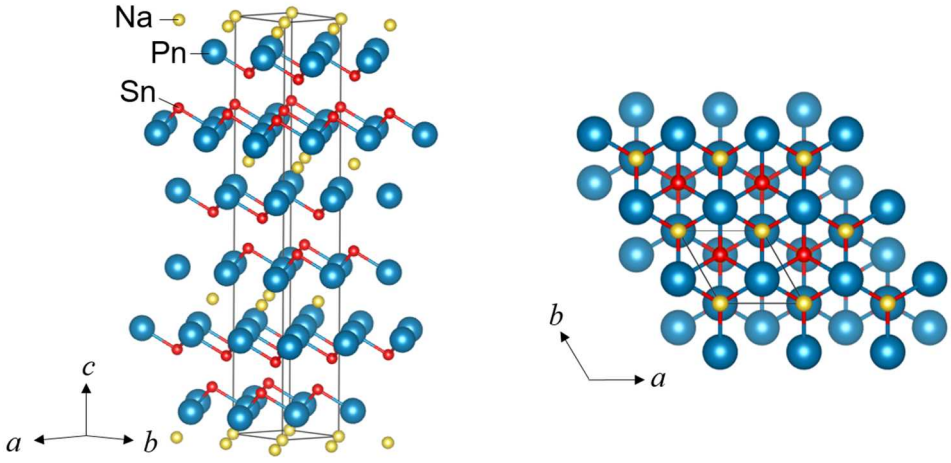
PC2-1-INV

Superconductivity in layered tin pnictides with a van der Waals-type structure

*Yosuke Goto[1], Yoshikazu Mizuguchi[1]

Tokyo Metropolitan University[1]

A layered crystal structure is an attractive stage to explore superconductors with a high transition temperature (T_c) and to discuss the mechanisms of unconventional superconductivity, as exemplified by the cuprates and the Fe-based superconductors. The discovery of a basic structure, which works as a superconducting layer, such as the CuO_2 plane and the Fe_2An_2 (An = P, As, S, Se, Te) layer, have opened new physics and chemistry fields on low-dimensional superconductors because many structural analogous could be designed by changing the structure or the alignment of the spacer layers as well as superconducting layers.
Recently, we reported SnPn-based (Pn: pnictogen) layered compounds $NaSn_2As_2$ and $Na_{1-x}Sn_2P_2$ [1,2] as a new class of van der Waals (vdW)-type superconductors. The crystal structure of these compounds is characterized by two layers of a buckled honeycomb network of SnPn, bound by the vdW forces and separated by Na ions, as shown in Figure 1. Measurements of electrical resistivity and specific heat indicate the bulk nature of superconductivity with transition temperature (T_c) of 1.3 K for $NaSn_2As_2$ and 2.0 K for $Na_{1-x}Sn_2P_2$. Temperature-dependent magnetic penetration depth [3] and thermal conductivity [4] of $NaSn_2As_2$ indicate that the superconducting state can be classified into a fully gapped *s*-wave state with atomic-scale disorder.
In 2018, Cheng et al. reported the T_c of $NaSn_2As_2$ as 1.6 K [4], which is slightly higher than that reported in our previous work. Furthermore, they observed charge-density-wave-like anomaly in resistivity and specific heat at around 190 K. We found that off-stoichiometry in this compound, namely, Na doping on the Sn sites ($Na_{1+x}Sn_{2-x}As_2$) increases T_c to around 2.1 K [5]. Local structure analysis using extended X-ray absorption fine structure also detected the anomaly at around 190 K [6]. In the conference, we discuss detailed electronic structure of SnPn-based layered materials, as well as the synthesis of novel compounds.



Reference
[1] Y. Goto et al. J. Phys. Soc. Jpn. **86**, 123701 (2017).
[2] Y. Goto et al. Sci. Rep. **8**, 12852 (2018).
[3] K. Ishihara et al. Phys. Rev. B **98**, 20503 (2018).
[4] E. J. Cheng et al. EPL **123**, 47004 (2018).
[5] H. Yuwen et al. Jpn. J. Appl. Phys. **58**, 083001 (2019).
[6] G. Pugliese et al. J. Phys.: Cond. Mater. DOI: 10.1088/1361-648X/ab2bd4.

Keywords: pnictide, layered structure