Effect of Element Substitution on the Physical Properties in the misfit layered compound $(BiSe)_m(TaSe_2)_n$

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Abstract

Misfit layered compounds, denoted by $[(MX)_{1+\delta}]_m(TX_2)_n$ (M: Pb, Bi, Sn, and rare earth, T: transition metals, X: S, Se), consist of alternating stacking of m insulating MX layers and n conducting TX_2 layers, stacked through van der Waals. Partial materials belonging to this compound exhibit superconductivity, and their superconducting transition temperature (T_c) varies depending on the number of m and n. For $(BiSe)_{1.10}(NbSe_2)$, T_c is approximately 2.7 K, and the upper critical field (μ_0H_{c2}) differs depending on the in-plane crystal axis [1]. We have attempted electron carrier doping by substituting Ag for the Bi site in this compound and found that Ag substitution varied both Tc and μ_0H_{c2}.

In this study, we investigated the effect of Ag substitution at the Bi site on the superconducting properties of $(BiSe)(TaSe_2)_n$ single crystals to determine whether Ag can be substituted in materials with other TX_2 layers. These single crystals were grown using the flux method. As a result, Obtained crystals were evaluated by the X-ray diffraction (XRD), elemental composition analysis and temperature and magnetic field dependent resistivity measurements. XRD measurements revealed that the diffraction peaks of the Ag-substituted samples shifted toward higher angles, and the calculated lattice constant along the c-axis decreased accordingly (Fig.1). Furthermore, compositional analysis confirmed the presence of Ag in the crystals.

In the presentation, we will introduce and discuss the changes in the superconducting properties by Ag-substitution.

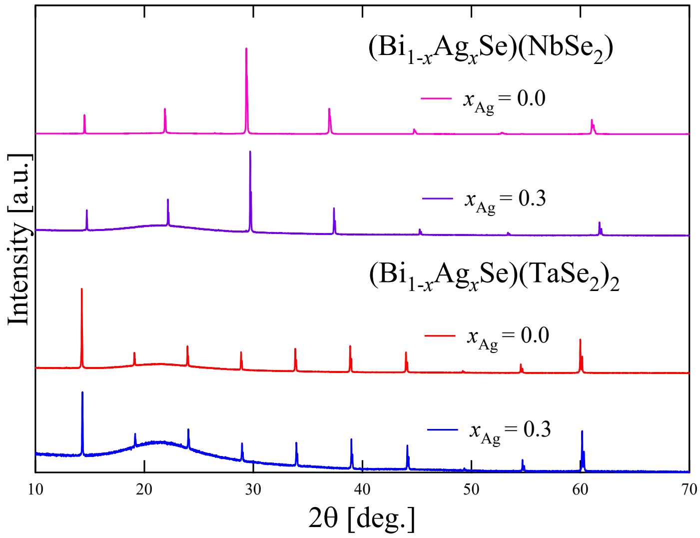

Figure 1 XRD results of $(Bi_{1-x}Ag_xSe)(NbSe_2)$ and $(Bi_{1-x}Ag_xSe)(TaSe_2)_2$, $x_{Ag} = 0.0, 0.3$

References

[1] S. Matsuzawa et al., J. Phys. Conf. Ser. 2545 012002 (2023)

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