PM-07

doi: 10.1093/jmicro/dfz087

Structure Characterization of Bi-Doped SnSe Thin Films Fabricated by Pluse Laser Deposition

Yoshiki Hirayama, Manabu Ishimaru, Tomoya Horide and Kaname Matsumoto

Department of Materials Science and Engineering, Kyushu Institute of Technology, Kitakyushu, Fukuoka, Japan.

Tin selenide (SnSe) has an orthorhombic structure with a = 1.149, b = 0.444, and c = 0.414 nm, and shows an excellent thermoelectric performance in the b- and c-axes directions. The crystallographic orientation can be controlled by thin films epitaxially grown on a substrate, but the structures of SnSe thin films have not been elucidated yet. In the present study, we performed structural characterization of SnSe thin films using TEM and STEM. SnSe thin films were deposited on a $SrTiO_3$ substrate at 300 ºC by pulse laser deposition using a target consisting of 50% Se, 44% Sn, and 6% Bi. Fig. 1 shows a cross-sectional bright-field TEM image of Bi-doped SnSe thin film. Columnar contrasts consisting bright and dark regions are observed from the substrate to the surface in the thin film [1]. Electron diffraction experiments revealed that the thin film consists of (001) and (010) domains with the a-axis parallel to the growth direction: the lattice is rotated by 90° around the a-axis. The SnSe thin film has almost the same structure as the single crystal, but numerous stacking faults perpendicular to the growth direction were included. Element mapping and high-angle annular dark-field images revealed that two types of Bi precipitates exist: large precipitates with the size of 100 nm and small ones with 10 nm. The former exists on the domain boundary, while the latter is formed inside the domain. We will discuss the relationships between structures and thermoelectric properties of SnSe thin films in the poster session.

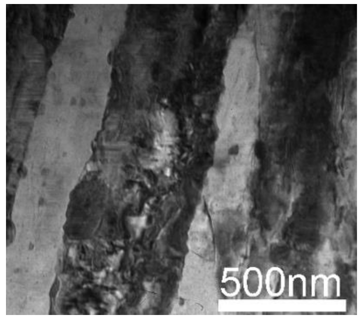

Fig. 1. Cross-sectional bright-field TEM image of Bi-doped sample.

1. T Horide et al., ACS Appl. Mater. Interfaces 11 (2019) 27057-27063.

PM-08

doi: 10.1093/jmicro/dfz100

Precipitation of Pigeonite and Enstatite in Augite of Ultrahigh Temperature Metamorphic Rock from Antarctica

Shoichi Toh[1], Tomoharu Miyamoto[2]

[1] Fukuoka University, Faculty of Science, Fukuoka, Japan, [2] Kyushu University, Faculty of Science, Fukuoka, Japan.

Since the rocks and minerals that compose earth and planetary materials may have traces of temperature, pressure, and stress, their formation history, occasionally, can be obtained by analysing them. In Antarctica, ultrahigh-temperarture (UHT) metamorphic rocks were found as the major component of old continental crust. The UHT metamorphic rocks are recognized from paragenesis and texture of constituent minerals, and thought to have been formed at the 1000°C or higher temperature condition [1]. Considering about their origin are important for understanding behaviour and history of such rocks and continental crust.

In the present study, we found a characteristic precipitation structure in pyroxene in ultrahigh temperature metamorphic rocks collected in Skallevikshalsen, Dronning Maud Land, East Antarctica. Based on the principles that have been clarified from research on pyroxene dissolution phenomena, a working hypothesis about the tissue formation process was established. The purpose of this study is to elucidate the temperature history that led to the formation of a characteristic structure by examining the hypothesis and reconstructing it as necessary. Careful observation and analysis were performed using a polarizing microscope, SEM and EPMA. Furthermore, the orientation of the interface boundary and morphology of the precipitated phases were examined using an analytical electron microscope (AEM). Microscopic observations using a polarizing microscope and EPMA analysis suggest that only Ca and Fe may be substituted between the matrix and the precipitates. And morphology change phenomena [2] was observed in pigeonite precipitates using AEM. Estimation of temperature history based on chemical composition and crystallographic data will be presented.

1. Yoshimura et al., Geodynamic evolution of East Antarctica, Geological Society, Spec. Pub., SP308, (2008), 377-390.
2. Kitamura et al., Proc. Japan Acad., 57, Ser. B, (1981) 183-187.