SW1-07

Phase transition characteristics of $Ge_2Sb_2Te_5$ and N-incorporated $Ge_2Sb_2Te_5$

<u>장문형</u>, 박승종, 임동혁, 조만호[1], 이연진[2], 고대홍, 손현철[3], 김형섭, 이후정[4]

[1]연세대학교 물리 및 응용물리 사업단, [2]한국표준과학연구원 나노측정센터,
[3]연세대학교 세라믹공학과, [4]성균관대학교 신소재공학부

The phase-change materials $Ge_2Sb_2Te_5$ (GST) and N-doped $Ge_2Sb_2Te_5$ (NGST) films were investigated using several physical measurement methods. Some nitrogen is initially located inside the lattice, resulting in a increase in crystalline temperature and electrical resistance. As the amount of incorporated nitrogen increases, excess nitrogen accumulates in the grain boundaries, which does not contribute to the increase in electrical resistance and the crystallization temperature. Ge–N and N_2 molecular states were present in the film and gradually increased in proportion to the amount of incorporated nitrogen. In addition, the nitrogen states were very stably maintained even during the phase transition process. The electronic structures of GST and NGST films during the phase transition were investigated using high-resolution x-ray photoemission spectroscopy. We found out that the changes in tetrahedral and octahedral coordinated Ge 3*d* peaks are closely related to the chemical bonding state of GST films. The incorporation of nitrogen affects its structure and chemical bonding state. The incorporation of nitrogen also increases the optical band gap of the film due to the formation of a nitride. The change in the unoccupied electronic states due to the shift of the absorption edge was investigated using energy X-ray absorption spectroscopy. The data showed that the tetrahedral structural coordination of Ge–Te is changed to octahedral coordination. In addition, nitrogen incorporation into the film led to a *p-p* orbital hybridization and a different crystallization behavior by the formation of a Ge–N bond.