Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Optimization of p-type SnSe thermoelectric performance by controlling vacancies. NGUYEN VAN QUANG, DUONG ANH TUAN, DUONG VAN THIET, NGUYEN THI MINH HAI, GANBAT DUVJIR, TRINH THI LY, KIM JUNGDAE, CHO SUNGLAE[1], University of Ulsan — SnSe is a p-type layered semiconductor with orthorhombic structure, whose ZT of 2.6. So far, several doping studies have been done for this material to optimize carrier concentrations 10^{19}-10^{20} cm^{-3} where the maximum ZT usually occurs. Recently, we have investigated intrinsic defects in SnSe using STM, resulting in that the Sn vacancy moves the Fermi energy inside dispersive valence band and produces extra holes, leading to the p-type characteristics of SnSe. Here we report that Sn vacancies of SnSe have been successfully controlled by changing cooling rate during the growth. The hole concentration is found to linearly increase with cooling rate, confirmed by Hall measurement and STM images. Room temperature hole concentrations were 0.53, 0.94, 2.00, 2.70, and 6.40×10^{17} for samples with the cooling rate of 0.5, 1.0, 2.0, 3.0, and 5.0 ^{o}C/h, respectively. The electrical conductivity decreased while Seebeck coefficient increased with cooling rate. The optimal cooling rate to achieve the highest ZT as well as the thermoelectric properties will be discussed.

[1]Corresponding author

Nguyen Van Quang
University of Ulsan

Date submitted: 07 Mar 2017 Electronic form version 1.4