Synthesis and properties of thermoelectric InSe Single-Crystal

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Thermoelectric material InSe has recently been discovered to exhibit high flexibility at room temperature[1] with the origin of the flexibility being attributed to the very layered structure of the material. This discovery opens the possibility of searching for novel flexible thermoelectric materials. To perform meaningful search of ductile inorganic compounds, understanding of the origin of the flexibility must be understood. Production of flexible thermoelectric single crystals is vital to advance the understanding of the flexibility. An InSe bulk single crystal has been grown using the travelling solvent floating zone technique[2] on a CSC Four Mirror Optical Floating Zone Furnace.

The poster presents the travelling solvent floating zone method as applied on the growth of InSe of ~3 cm in length and a diameter of ~7 mm. The orientation of the single crystal is found using powder x-ray diffraction. Single crystal x-ray diffraction data is also presented. Thermoelectric properties, measured along the direction of the layers in the structure, are presented. From thermopower measurements, the sample is found to exhibit a n-type to p-type transition at ~250 K; the change between n-type and p-type semiconductor is not yet understood. Furthermore, a transition to an insulator at ~210 K is observed suggesting a freeze-out of the carriers owing to the very small amount of dopants in the pure InSe.

References

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2. Kimura, S. and I. Shindo, *Single-Crystal Growth of Yig by Floating Zone Method.* Journal of Crystal Growth, 1977. **41**(2): p. 192-198.