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Structural modulation and enhanced thermoelectric properties of thermoelectric thin films

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SnSe single crystals have been demonstrated to possess excellent thermoelectric properties. In this work, we demonstrate a grain size control method in growing nano crystalline SnSe thin films through a glancing angle pulsed laser deposition approach. Structural characterization reveals that the SnSe film deposited at a normal angle has a preference orientation along an axis, while by contrast, the SnSe film deposited at a glancing angle develops a nano pillar structure with the growth direction towards the incident atomic flux. The glancing angle deposition results in a reduced grain size of the thin film and enhanced thermoelectric properties with increased seebeck coefficient. The enhancement of thermal power can be attributed to the increased potential barriers owing to the reduced grain size and increased grain boundaries in the film. We also demonstrated this approach in other thermoelectric thin films such as SnTe. This finding provides an alternative strategy to enhance thermoelectric performance of thin films.

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