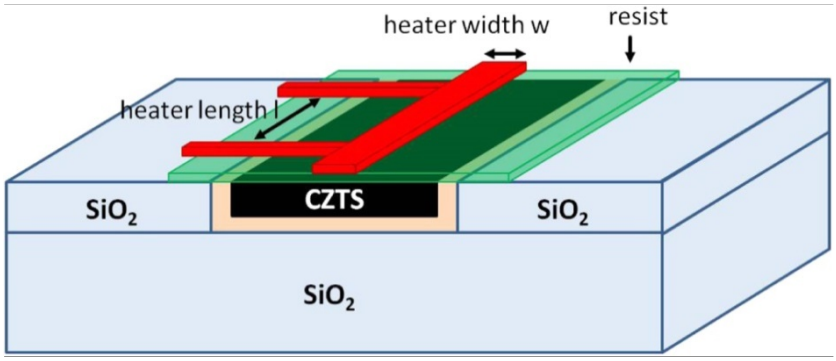
Thermal and electrical conductivity of single crystalline kesterite Cu_2ZnSnS_4

M. Handwerg, R. Mitdank, S. Levcenco, S. Schorr and S. F. Fischer

Mater. Res. Express **7**, 105908 (2020).

Short Abstract

Kesterites are materials with a unique crystal structure and rich in non-toxic earth abundant zinc and tin, and so of great potential as mass-producible yet efficient thin film solar cell materials. Here, we investigate the thermal conductivity of a kesterite Cu_2ZnSnS_4 single crystal in the temperature range from 20 K to 320 K. The electrical conductivity decreases exponentially with decreasing temperature. From the temperature-dependence of the thermal conductivity the influence of multiple scattering events of the phonons is determined. At lower temperatures the scattering of phonons at defects dominates the thermal transport and at higher temperatures the phonon-phonon-Umklapp-scattering has the highest impact.



Above. Schematic measurement setup containing the kesterite CZTS crystal glued and polished between two glass wafers. An electrically insulating photoresist of about 1 μm is placed on top of the crystal. A photolithographic designed gold heater line is placed on top of the resist.