Thermal conductivity, diffusivity and specific heat capacity of as-grown, degenerate single-crystalline $ZnGa_2O_4$

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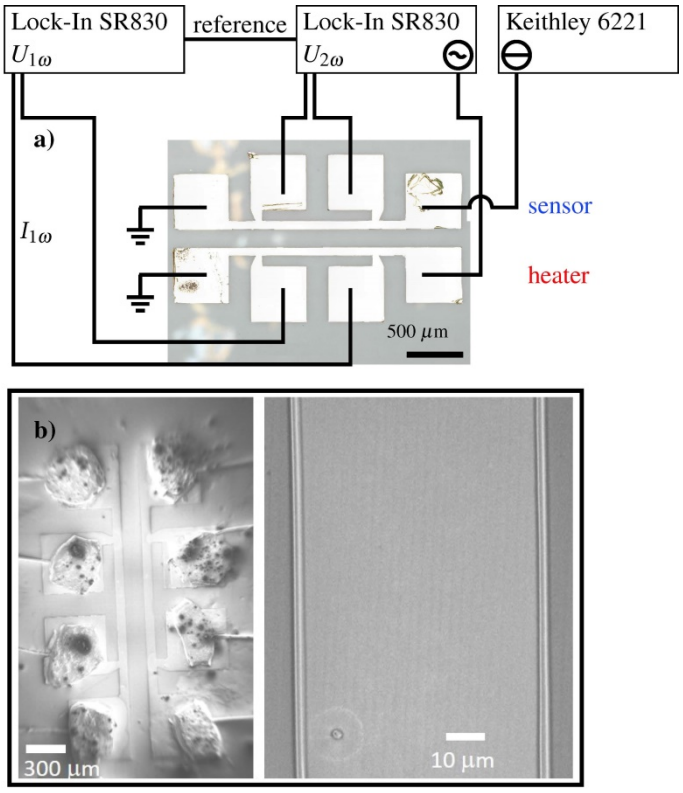
Short Abstract

The first experimental determination of the low-temperature thermal properties for novel highly pure single-crystalline $ZnGa_2O_4$ is reported. The thermal conductivity and diffusivity were determined by the so-called 2ω-method, for which metal lines with a Schottky barrier were fabricated to electrically conducting $ZnGa_2O_4$. At room temperature the thermal conductivity is $\lambda \approx 22.9$ W/mK and for temperatures above 100 K the phonon transport is limited by phonon Umklapp scattering. At lower temperatures boundary scattering at lattice defects limits the thermal conductivity to $\lambda \approx 95$ W/mK. Therefore, if the cause of boundary scattering is reduced or eliminated, the thermal conductivity of $ZnGa_2O_4$ may be increased at low temperatures.



Above. Schematic overview over the 2ω-measurement setup. The microscopic image shows the $ZnGa_2O_4$ surface with the four-point metal lines on top. The blurred metal structures originate from the thermoelectric measurement platform on the other side of the sample, which were used in another study. b) Electron micrograph of titanium/ gold heater- and sensor lines, indium contacts and gold wires.