Temperature-dependent thermal conductivity and diffusivity of Mg-doped insulating ß-Ga_2O_3 single crystal along [100], [010] and [001]

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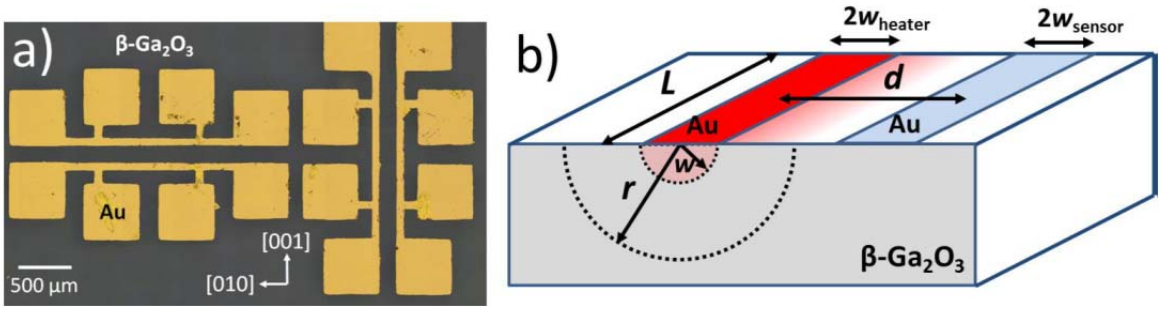
Short Abstract

The monoclinic crystal structure of β-Ga_2O_3 leads to significant anisotropy of the thermal properties. The 2ω-method is used to measure the thermal diffusivity D in [010] and [001] direction and to determine the thermal conductivity values λ of the [100], [010] and [001] direction from the same insulating Mg-doped β-Ga_2O_3 single crystal. We detect a temperature independent anisotropy factor of both the thermal diffusivity and conductivity values of $D_{[010]}/D_{[001]} = \lambda_{[010]}/\lambda_{[001]} = 1.4 \pm 0.1$. The temperature-dependence is in accord with phonon-phonon-Umklapp scattering processes from 300 K down to 150 K.



Above. a) An arrangement of two line heater pairs on top of the Mg-doped β-Ga_2O_3-crystal. b) The anisotropic thermal conductivity measurement setup to measure the temperature ow between two metal lines (Au) through the β -Ga_2O_3-crystal with a thickness of t = 0:5 mm.