Temperature-dependent thermal conductivity in Mg-doped and undoped β-Ga_2O_3 bulk-crystals

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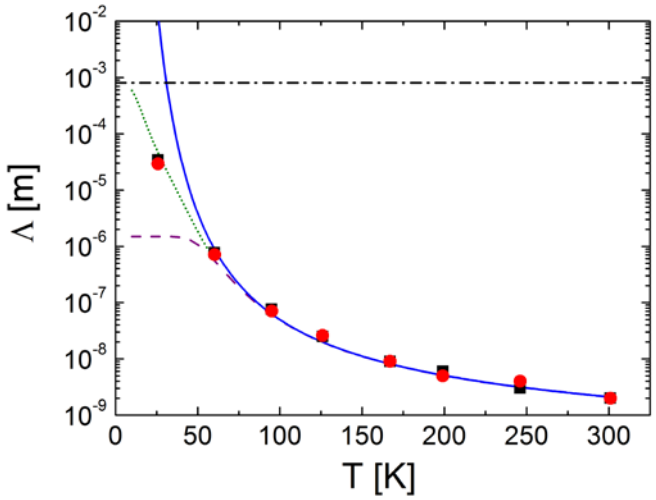
Invited Article

Short Abstract

Gallium oxide (β-Ga_2O_3) is one of the few conducting transparent oxides, yet only little is known concerning its thermal properties, especially the thermal conductivity λ. Here, the thermal conductivity is measured by applying the electrical 3ω-method on Czochralski-grown β-Ga_2O_3 bulk crystals. The thermal conductivity increases for decreasing temperature while the phonon contribution of λ dominates over the electron contribution below room temperature. The observed function λ (T) agrees with phonon-phonon-Umklapp scattering, of which a detailed discussion for $T < \theta_D$ (Debye temperature) is provided.



Above. The temperature dependent mean free path of phonons in the insulating Magnesium-doped β-Ga_2O_3. The solid line is the theoretical contribution for phonon-phonon-Umklapp-scattering and the dashed line shows additionally a contribution of a second scattering process with a constant mean free path of 1:5 μm. The dotted line describes point-defect-scattering within the scope of Rayleigh scattering.