Temperature-dependent electrical characterization of exfoliated β-Ga_2O_3 micro flakes

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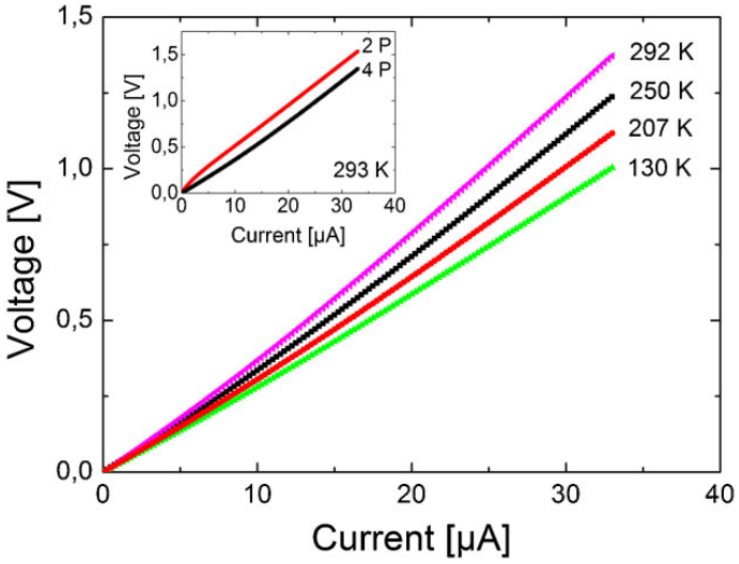
Physica status solidi (a) **211**, No. 3, 543-549 (2014).

Short Abstract

Among the transparent semiconducting oxides, β-Ga_2O_3 is of high interest because of its wide-band gap of 4.8 eV and the corresponding transparency from deep ultraviolet to near infrared spectra. Here, we report on the preparation, structural and temperature-dependent electrical characterisation of thin β-Ga_2O_3 micro flakes. Transport investigations were performed in the temperature range from 30 to 300K. The electrical resistivity at room temperature amounts to ρ(293 K)=(1.5±0.5)Ωcm. The temperature-dependent resistivity has a minimum at T=130K of about ρ(130 K)~1Ωcm. From the increase of ρ(T) between 130 and 300K we determine an activation energy of E_a=(-10.5±0.4)meV. For temperatures below 50K ρ(T) increases indicating a freeze-out of charge carriers.



Above. Voltage-current characteristics for a β-Ga_2O_3 190 nm thin flake measured in four-point geometry at temperatures from 130K up to 300 K: The resistance increases with increasing temperature. Inset: Comparison of two- and four-point measurements at 300 K. At currents above 20mA the determined resistances are identical.