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Thermal conductivity and thermoelectric power of heavily doped n-type silicon

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Abstract

Experimental values are given of the thermal conductivity and thermoelectric power of n-type silicon doped with phosphorus, antimony or arsenic, containing $4*10^{19}$ to $6*10^{25}$ m^{-3} electrons at room temperature, covering the range 4-300 degrees K. A theoretical treatment, using the variational method, suggests that the ratio of phonon drag component of thermoelectric power to thermal conductivity should be independent of carrier concentration, if the latter is not too large. This is verified experimentally; the temperature variation of the ratio is in satisfactory agreement with theory, which also gives the correct order of magnitude for the absolute value.