POWER FACTOR FOR LAYERED THERMOELECTRIC MATERIALS WITH A CLOSED FERMI SURFACE IN A QUANTIZING MAGNETIC FIELD

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S u m m a r y

The field dependence of the power factor for a layered thermoelectric material with a closed Fermi surface in a quantizing magnetic field and at helium temperatures has been studied in the geometry where the temperature gradient and the magnetic field are perpendicular to the material layers. The calculations are carried out in the constant relaxation time approximation. In weak magnetic fields, the layered-structure effects are shown to manifest themselves in a phase retardation of power factor oscillations, increase of their relative contribution, and certain reduction of the power factor in whole. In high magnetic fields, there exists an optimal range, where the power factor reaches its maximum, with the corresponding value calculated for the chosen parameters of the problem in the effective mass approximation being by 12% higher than that for real layered crystals. Despite low temperatures, the power factor maximum obtained with those parameters in a magnetic field of 1 T has a value characteristic of cuprate thermoelectric materials at 1000 K. For this phenomenon to take place, it is necessary that the ratio between the free path of charge carriers and the interlayer distance should be equal to or larger than 30,000. However, in ultraquantum magnetic fields, the power factor drastically decreases following the dependence $P \propto T^{-3}B^{-6}$. The main reason for this reduction is a squeeze of the Fermi surface along the magnetic field in the ultraquantum limit owing to the condensation of charge carriers on the bottom of a single filled Landau subband.