THE NATURE OF THE FORMATION OF THE TEMPERATURE DEPENDENCE OF THE RESISTIVITY IN CONDUCTORS

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The modern theory of electrical resistivity of conductors undergoes a crisis in solving such questions as: a quantitative description of the temperature dependence of the phonon resistivity, even for pure, normal metals; a quantitative description of the temperature dependences of the resistivity at magnetic and atomic ordering and disordering; the nature of the conductivity of high-temperature superconductors, in which free and non-localized charge carriers are absent; interpretation of the negative temperature coefficient of electrical resistance for conductors with high static disorder. Moreover, there is a contradiction connected with the direct and inverse dependence of the conductivity of materials on the relaxation times in the expressions of Bloch and Maxwell, respectively. In both cases, it is expected that the sistem relaxes to the initial state as a result of its linear reaction to a deviation from the charge homogeneity when an electric potential gradient satisfying Ohm's law is established.

The development of technologies similar to those observed in nature for obtaining materials and products from them requires fundamental knowledge, including on conductivity and its connection with the structure and other properties of these materials, based on reliable empirical data. A reliable source of data on the temperature dependence of the properties of materials is still the experimental results.

Based on the experimental data on the temperature dependences of the electrical resistivity and thermal expansion obtained in situ for metals and alloys, a close relationship has been found between the electrical resistivity and the of the coefficient of thermal expansion multiplied by temperature. This connection does not contradict the recognized positions of the theory of conductivity and is empirically justified. It indicates the determining role of the thermal deformation of the lattice of atoms in the formation of the temperature dependence of the electrical resistivity of conductors. The presence of such a connection allows us to establish the nature of the conductivity of materials from the first principles of the first level.

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