The Effect of the Electron Correlation on the Electrical Resistivity of Liquid Metals

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The Effect of the Electron Correlation on the Electrical Resistivity of Liquid Metals*

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Abstract

An elementary theory of the electrical resisitivity of monovalent liquid metals is given. On using the theory of the plasma oscillations of conduction electrons, the electron-ion interactions are separated into two parts: one gives the effective electron-ion interactions which are screened as the result of the effects of the plasma oscillations of the conduction electrons and contributes directly to the electrical resistivity; the other describes the interactions between the ions and the plasma oscillations. The screened electron-ion interaction is defined as the pseudo-potential of the ion.

The theory constructed on the basis of the free-electron model is applied in the first instance to estimate the electrical resistivity of liquid sodium near the melting point. Callaway's potential and the correlation function of ions determined from neutron diffraction experiments are used and the mean free path of a conduction electron is calculated numerically. Therefore, in our theory, the "plasma term" and the "structure term" of Ziman's theory are not treated separately.

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