*Letters to the Editor*

# SOME NOTES ON THE STUDY OF ELECTRICAL AND MAGNETIC PROPERTIES OF THE SYSTEM $UFe_2$—$UCo_2$[1]

## НЕСКОЛЬКО ЗАМЕЧАНИЙ ОБ ИССЛЕДОВАНИИ ЭЛЕКТРИЧЕСКИХ И МАГНИТНЫХ СВОЙСТВ СИСТЕМЫ $UFe_2$—$UCo_2$

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An explanation based on the model of strong scattering is given for the observed high values of electrical resistivity, which are typical also for the other uranium compounds. From the temperature and field dependences of the magnetic moments of $UFe_{1.5}Co_{0.5}$ the Curie temperature and the number of the Bohr magnetons is derived.

One of the typical properties of uranium compounds is their high residual resistivity $\varrho_0$ (Fig. 1). In this contribution we shall treat briefly the strong scattering which is able to explain qualitatively both this behaviour and the decrease of resistivity $\varrho$ with increasing temperature (UNiFe, see [1]). Completing the data of [2] we shall draw our attention mainly to the system $UFe_2 - UCo_2$.

In contrast to pure metals or dilute alloys at finite temperatures in our case of concentrated alloys the mean free path of electrons is comparable to inter-atomic distances, i.e. the time of life of electrons in a certain state is rapidly shortened and the uncertainty of an electron momentum is higher than the momentum itself. The semi-classical approximation for the resistivity of concentrated alloys is not applicable in this case. Chen et al. [3] using the method of Green's functions have given a convenient formula in which the density of states depends upon a few parameters (e.g. concentration, potencial of atoms, electron-phonon interaction). By proper choice of these parameters various curves of density of states may be obtained. In dependence on the relation between these curves and the Fermi surface the increase or decrease of resistivity vs. temperature appears. Physically, these effects can be understood if one considers that the phonons enable jumps between localized, strongly dumped states.

At the present state of research we cannot adjust the theoretical parameters of the model of strong scattering for our case of UNiFe. We only suppose that the Fermi surface is situated at the minimum of the density state curve. The decrease of resistivity $\varrho$ with increasing temperature $T$ in UNiFe may be connected with the maximum in the dependence $d\varrho/dT$ vs $T$, which appears at the highest temperature of all $UFe_2$—$UNi_2$ compounds [4].

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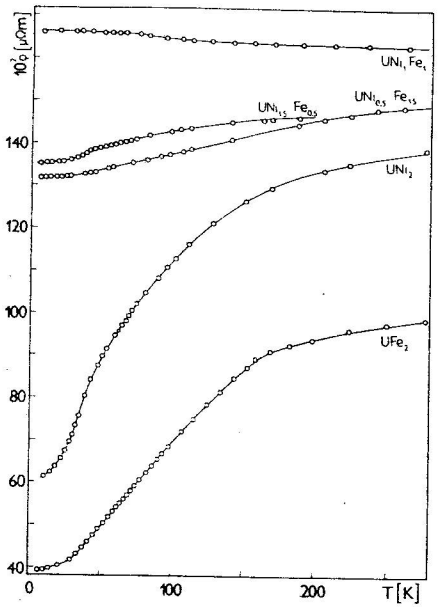


Fig. 3. Dependence of magnetization $\sigma$ upon temperature $T$ for $UFe_{1.5}Co_{0.5}$ at the magnetic field $H = 4.2$ T.

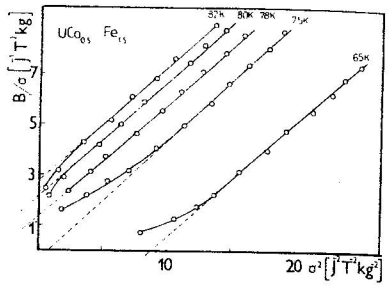


Fig. 1. Dependence of electrical resistivity $\varrho$ upon temperature $T$ for the $UFe_2$—$UCo_2$ and $UFe_2$—$UNi_2$ systems.

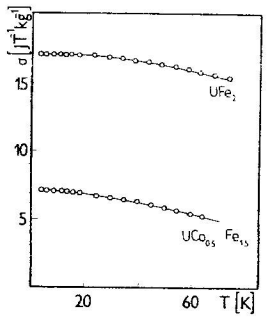


Fig. 2. Dependence of $B/\sigma$ upon $\sigma^2$ at various temperatures for $UFe_{1.5}Co_{0.5}$.

Coming back to the $UFe_2$—$UCo_2$ system we state first of all that the magnetic order disappears below 61 at. % of Fe [2]. For $UFe_{1.5}Co_{0.5}$ we have studied the magnetic moment and the Curie temperature. The Arrott plots are shown in Fig. 2. From these plots it follows that $UFe_{1.5}Co_{0.5}$ is magnetically ordered below the temperature $T_c = 76$ K with the magnetic moment 0.46 $\mu_B$ per mol. Magnetization at the field of 4.2 T in dependence on temperature is compared for $UFe_2$ and $UFe_{1.5}Co_{0.5}$ in Fig. 3. The similarity between $UFe_2$—$UCo_2$ and $UFe_2$—$UNi_2$ systems as to electrical properties is seen from Fig. 1.

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