HIGH-TEMPERATURE THERMOPHYSICAL PROPERTIES OF SOLID SOLUTIONS OF THE Y-Ho SYSTEM

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The thermal diffusivity of the Y-Ho system was studied by us earlier [1], and it was shown that the concentration and temperature dependences of thermal diffusivity exhibit a number of unusual features. To establish the concrete nature of the change in properties, we undertook a detailed study of the complex of thermophysical characteristics of twenty samples of different compositions of this system in the interval from 400 K to the melting point. The thermal diffusivity, relative heat capacity, thermal conductivity, specific electric resistance, and electronic thermal conductivity were studied. The thermal characteristics were investigated by the temperature wave method [2] in the helium atmosphere. The electrical resistance was studied by a four-probe method at a constant current, too, in an helium atmosphere. The phase diagram of the Y-Ho system is fairly simple, and indicates an unrestricted mutual solubility of the components. In alloys rich in yttrium, at temperatures close to melting, a phase transition from the hcp structure to the bcc is noted. The experiment showed that the temperature dependences of the properties studied are monotonous nondecreasing in nature. The transfer of heat is carried out mainly by an electronic mechanism. Collectivated electrons have a multiband energy structure. Within the measurement error, there are no anomalous changes in the properties near the temperatures of the structural transitions. The lattice component of the thermal conductivity is estimated. Concentration dependencies on the whole have the character established in [1], however, additional features were found. In particular, a noticeable difference in properties is recorded only for regions in which the holmium concentration is less than 30%. As a consequence, the Nordheim rule for these alloys is not satisfied. The magnetic contribution to the scattering of carriers is not described in the framework of the available models. This work was supported by the Russian Foundation for Basic Research (grants No. 11-08-00275 and No. 14-08-00228).

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2. Ivliyev A. D. //HighTemperature, 2009. V. 47, No. 5, P. 737.