Thermophysical Properties of Fe, Co and Fe-Co Alloys in the Temperature Range 4.2 - 1800 K

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Complex investigations of electric resistivity, thermal diffusivity, heat capacity and thermal conductivity of Fe, Co and Fe-Co alloys have been performed in the temperature range 4.2 - 1800 K. The alloys with Co content 0.8, 2.3, 2.7, 8.9, 18.2, 21.6, 30.8, 51.2, 68.4, 92.8, 99.1 weight% were investigated.

Thermal diffusivity of metals in the temperature range from 800 K to the melting point was measured by the dynamical method of plane temperature waves with the error equal to 4%. Heating velocity in the course of measurements varied from 10 to 200 K/sec, modulation frequency varied from 5 to 30 Hz. The amplitude of temperature oscillations was not more than 0.5 K. The state of specimens and the moment of liquid phase formation were monitored by a videocamera. Thermal diffusivity of alloys in the temperature range 80 - 1000 K was measured by the method of plane temperature waves, phase of temperature oscillations was determined by the laser interferometric technique with the error equal to 5%. Heat capacity of the specimens was measured in the temperature range 900 - 1600 K by the calorimeter Setaram TAG-24 in the differential mode with the error equal to 5%. Electric resistivity was measured by the four-probe potentiometric method with the error 1%. All investigations were performed in vacuum 10^{-3} Pa or in the noble gas atmosphere.

The obtained results on the temperature-concentration dependences of electric resistivity and thermal conductivity of Fe-Co alloys allow to make a conclusion, that at low temperatures thermophysical properties of this alloys are well described by the two-band s-d scattering Mott's model. At high temperatures on condition that electrons mean free path approaches to the mean interatomic distance, the process of single-band scattering of electrons on disordered spins becomes dominating. During the process of melting heat conductivity of Fe, Co and Fe-Co alloys varies only on 5-8%. Therefore the models of liquid state for this metals and alloys must take into consideration effects corresponding to electrons short free path.