Cobalt in the Solid and Molten States

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Within this study, physical and optical properties as a function of temperature for pure cobalt samples are investigated in order to provide an updated and almost continuous set of data for solid and liquid cobalt. Using DSC, pulse-heating, and photopolarimetry, it is possible to extend the range of a classical solid phase DSC measurement to temperatures above the melting point on one hand and, in turn, to confirm liquid state pulse-heating data on the other hand.

Reported thermophysical properties besides specific enthalpy include isobaric heat capacity, latent heat of fusion, electrical resistivity, and, derived from the latter by using the Wiedeman-Franz-Lorentz relation, thermal conductivity and thermal diffusivity. All of the aforementioned properties are reported in a temperature range from 1200 to 2200 K, except for the isobaric heat capacity, for which DSC data exist from 500 to 1680 K, which also can be used to estimate the phase transition temperatures of solid cobalt.

Furthermore, a photopolarimeter-technique was used to perform emittance measurements resulting in normal spectral emittance at 684.5 nm data at the melting point and for molten cobalt. This result is in turn extremely useful for enhancing optical (pyrometric) temperature determinations, as used in pulse-heating experiments and many technical applications.

The results of this work are able to close the existing gap between the widespread literature data for the solid state and the little existing data at the melting transition and in the adjacent molten state. All data obtained are extensively discussed and reviewed, as well as compared to available literature references, in order to support and check these recent results.

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