

Abstract

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Measurement and estimation of thermo-physical properties of Nickel-based superalloys

Thermophysical properties for the solid and liquid phases of several Ni based superalloys (CMSX- 4, CMSX-10, CM186LC, IN 738 and Rene 80) have been measured. The following properties were measured: heat capacity; enthalpy, thermal expansion coefficient; density, thermal diffusivity, viscosity; surface tension. Analysis of these measurements showed that the γ' phase (Ni₃Al) affected the values for the following properties Cp, enthalpy, electrical resistivity, thermal diffusivity; conductivity. Relationships have been identified between properties and the γ' phase content (which can be represented by mass% Al in the alloy). These relations were then used to calculate property values of the alloys from chemical composition. Other relations were developed to estimate the viscosities and surface tensions of Ni based superalloys. The predicted property values were found to be in good agreement with the measured values.