HIGH TEMEPERATURE CALORIMETRY IN METALLIC SYSTEMS

Gabriella Borzone
Dipartimento di Chimica e Chimica Industriale
INSTM - UdR di Genova
Università di Genova
Via Dodecaneso 31 – 16146 Genova, Italy

The need of a concerted multi-disciplinary approach to the investigation of intermetallic systems and the role of thermochemistry are underlined. Both from a fundamental point of view and taking into consideration possible technological applications, the determination of the state diagram should be considered in order to define the stability ranges (temperature and composition) of the phases and, more generally, thermodynamic measurements are necessary. Thermochemical data play a relevant role in the evaluation and assessment of the alloy properties and are of particular interest in computational phase study and in the optimisation and prediction of phase equilibria in complex systems.

For a long time, in the Author's Laboratory, attention has been given to thermodynamic study by using mainly calorimetric techniques. Methods based on the so-called direct calorimetry have been used. These methods (which may be applied to the study of exothermic alloys) are based on the synthesis of the alloys carried out inside the calorimeter itself. Different types of direct calorimeters (working respectively at room and high temperature) have been built in our laboratory and used systematically in the study of different groups of alloys.
A summary is reported on alloys thermodynamics with special reference to the measurements and evaluation of the formation enthalpies by means of calorimetric techniques. The main calorimeters used in metallurgy are described and the experimental procedures, depending on the physico-chemical properties of the components (melting temperature, reactivity, vapour pressure, etc.) are discussed. Advantages and drawbacks of direct and indirect reaction calorimetry are highlighted.
Special attention is also paid to the accuracy of results obtained by using very high temperature calorimetry.