THERMOCHEMISTRY OF FORMATION OF Fe-Pr AND Fe-Nd ALLOYS

The thermochemical properties of binary liquid Fe-Pr and Fe-Nd alloys were determined by high-temperature isoperibolic calorimetry. The determination of partial mixing enthalpies was carried out at 1829 K for lanthanides and at 1550 K for iron in purified helium medium. It is shown that the process of alloying formation is accompanied by slight heat effects. Enthalpies of mixing in the Fe–Pr system are partially endothermic. Partial enthalpy of mixing of Pr for infinite dilution is found to be slight exothermic value of –3.6 ± 0.8 kJ·mol^{-1}, whereas the first partial enthalpy of Fe is endothermic with the value of 5.4 ± 1.8kJ·mol^{-1}. Enthalpies of mixing in the Fe–Nd system are completely exothermic through the whole concentration region with minimum integral enthalpy of mixing of –1.1 ± 0.4 kJ·mol^{-1} at x_{Nd} = 0.4. These facts indicate a weak chemical interaction between the components of investigated alloys of iron with light lanthanides due to the great size difference of the components. It is shown the complete applicability of "surrounded atom" model to description of concentration dependences of enthalpies of mixing for such systems. It is important aming the possibility of further modelling predictions of thermodynamic values in still uninvestigated binary and multicomponent alloys.

Keywords: Iron; Neodymium, Praseodymium, High temperature calorimetry, Enthalpy of mixing, Model of "surrounded atom".