**An experimental investigation of the formation enthalpy**

**of intermetallic phases in the TM(Co, Fe)–REM(Ho, Tb) systems**

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REM-TM intermetallic compounds are interesting mainly from the standpoint of developing the permanent magnets [[1],[2],[3]]. A thorough evaluation of the experimental data in rare-earth – (Fe, Co) systems and the analysis of their common features have been recently presented by Fartushna et al [4]. It has revealed the lack of data on the thermodynamic properties of the intermetallics. The data on the thermodynamic properties of REM–(Fe, Co) intermetallic compounds would complement the phase equilibria data and allow to make more reliable predictions of the phase composition and properties of the magnetic materials.

Thus the aim of the current work was the experimental determination of the enthalpies of formation of Co17Tb2, Co7Tb2 and Fe3Ho.

The compounds have been prepared by the arc-melting. The chemical and phase composition was checked by the means of SEM/EPMA and XRD. The standard formation enthalpies were obtained from the drop-solution experiments using a high-temperature isoperibol Tian-Calvet calorimeter AlexSys 1000 (Setaram, France). Pure Al (99.995 %) was used as a solvent bath. The experiment was carried out at 800 °С in Ar atmosphere (99.998 %).

The enthalpies of formation of the binary TM-REM compounds have been calculated using the reaction cycle from Table 1.

The resulting values of ∆*fH*° are following: ∆*fH*°(Co17Tb2) = –6296 ± 2001 (J/mol/atom), ∆*fH* (Co7Tb2) = –19909 ± 2137 (J/mol/atom) and ∆*fH*°(Fe3Ho) = –12007 ± 1893 (J/mol/atom).

Table 1. Reaction cycle for the calculation of the ∆*fH*° of the binary TM-REM compounds

|  |  |
| --- | --- |
| Reaction type |  |
| TM[*s*, *Tr*] → TM[*sol*, *Ts*] | Δ*H*(1) |
| REM[*s*, *Tr*] → REM[*sol*, *Ts*]  | Δ*H*(2) |
| TMxREMy[*s*, *Tr*] → *x*TM[*sol*, *Ts*] + *y*REM[*sol*, *Ts*] | Δ*H*(3) |
| ∆*fH*o(TMxREMy) = *x⋅*∆*H*(1) + *y⋅*∆*H*(2) – ∆*H*(3) |  |
| TM is transition metal: Co, Fe; REM is rare-earth metal: Tb, Ho.*s* means solid, *sol* means dissolved in pure Al, *Tr* is room temperature (298.15 К) and *Ts* is the temperature inside the calorimeter equal to 1073 K |

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