Ternary Phases in the Yb-Zn-Al System

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The facility of ytterbium to form compounds with zinc (eight phases in the Yb-Zn system) and the presence of $YbAl_2$ with intermediate valence in the Yb-Al system have led to the study of the ternary Yb-Zn-Al system with the aim of finding compounds with possible interesting magnetic properties.

The alloys were prepared by melting the elements and annealing at 600-750°C. All samples were examined by optical and microprobe analysis and the crystal structure was determined by X-ray powder and single crystal methods.

Thirteen phases were identified. Six of them correspond to phases already present in the Yb-Zn or Yb-Al system [1], where the third element substitutes the Zn or Al atoms, more or less extensively, maintaining the same structure. Examples are $YbZn_{0.88}Al_{1.12}$ ($MgCu_2$-type) and $Yb_3Zn_{4.48}Al_{6.16}$ (La_3Al_{11}-type). Six ternary compounds crystallize with other known structure types. Examples are YbZnAl ($MgNi_2$-type) with all mixed Zn/Al occupations of the Ni sites and $Yb_8Zn_{48.5}Al_{17.5}$ isotypic with $Yb_8Cu_{17}Al_{49}$ [1], with partial ordering of the Zn atoms. A new hexagonal structure is observed for $YbZn_{7.3}Al_{0.5}$, by taking nine $CaCu_5$ cells and substituting some of the Yb atoms (28.9%) with mixed Zn/Al pairs.This substitution mechanism, known for a long time, is found also in $YbZn_{7.8}Al_{0.4}$ and $YbZn_{9.2}Al_{1.3}$ with structures derived from the U_2Zn_{17} and $SmZn_{11}$ types, respectively.

[1] *CRYSTMET*, *Structure and Powder Database for Metals*, 2004.

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