Solid State Phase Equilibria in the Er-Ni-P and Er-Ni-As Systems at 800 °C

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Z. Naturforsch. **2007**, *62b,* 1143 – 1152; received March 14, 2007

Solid-state phase equilibria in the ternary systems Er-Ni-P and Er-Ni-As have been determined at 800 °C (region 0 – 67 at. % P or 0 – 50 at. % As) using X-ray diffraction, scanning electron microscopy and electron probe microanalysis. Eight ternary phosphides and six ternary arsenides have been synthesized, including several phases reported previously. The hexagonal structure of the new compound $Er_6Ni_{20}P_{13}$, as determined from single-crystal X-ray data, exhibits a new structure type closely related to the $Ho_6Ni_{20}P_{13}$ structure. Two other new phosphides, $Er_{16}Ni_{36}P_{22}$ ($Tb_{16}Ni_{36}P_{22}$-type) and $Er_{20}Ni_{42}P_{30}$ ($Sm_{20}Ni_{41.6}P_{30}$-type), have also been obtained at 800 °C. In the Er-Ni-As system, a new arsenide $Er_{20}Ni_{42}As_{30}$ ($Sm_{20}Ni_{41.6}P_{30}$-type) has been found in addition to known ternary phases. From X-ray powder data, the structures of the ternary arsenides $ErNi_4As_2$ ($ZrFe_4Si_2$-type) and $Er_2Ni_{12}As_7$ ($Zr_2Fe_{12}P_7$-type) have been refined by Rietveld methods. In the single crystal investigations, two other new phases $Er_{12}Ni_{30}P_{21}$ [derived $(La, Ce)_{12}Rh_{30}P_{21}$-type] and $Er_{13}Ni_{25}As_{19}$ ($Tm_{13}Ni_{25}As_{19}$-type) have been prepared by high-temperature annealing (1500 °C).

Key words: Rare Earth Compounds, Phosphide, Arsenide, Phase Diagram, Crystal Structure