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NEW PHOSPHIDES WITH TRANSITION AND RARE-EARTH METALS AND THEIR CRYSTAL STRUCTURES

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The interaction between components in systems $M - M' - P$ ($M - \text{Zr, Hf, Nb, Mo, W, Mn, Re}$; $M' - \text{V, Cr, Fe, Co, Ni, Cu}$), $\text{Ln} - \{\text{Fe, Co, Ni, Cu}\} - P$ ($\text{Ln} - \text{rare-earth metals}$) and $M - \{\text{Si, B}\} - P$ ($M - \text{Cr, Mo, W, Mn, Re, Co, Ni, Cu}$) have been investigated and isothermal sections for 47 ternary systems have been built. 98 new phosphides have been synthesized and the crystal structure for 76 has been determined. The structures of new compounds belong to the known structure types, such as MgCu_2 , $\text{Mg}_6\text{Cu}_{16}\text{Si}_7$, TiNiSi , $\text{Zr}_2\text{Fe}_{12}\text{P}_7$, $\text{Hf}_2\text{Co}_4\text{P}_3$, CeAl_2Ga_2 , ZrFe_4Si_2 , Nb_4CoSi , Mo_5SiB_2 , MgZn_2 , HfCuSi_2 . The structures of several phosphides represent the new types: Nb_2P , $\alpha\text{-Ni}_8\text{P}_3$, $\text{Zr}_2\text{Ni}_{1-x}\text{P}$, $\text{Tb}_{1-x}\text{NiP}$, SmNi_4P_2 , $\text{Nd}_3\text{Ni}_7\text{P}_5$, $\text{Ni}_{3,36}\text{Si}_{1,76}\text{P}_6$, $\text{Mo}_2\text{Ni}_6\text{P}_3$, $\text{Re}_{0,6}\text{Ni}_{0,4}\text{P}$. The obtained experimental data allowed us to make the following conclusions:

1. The atomic substitution of iron triad metals by phosphorus during the solid solution formations in $M - M' - P$ systems was found for the first time.
2. Phosphides with 0-0,25 at part P content belong to the structure types, which are usual for intermetallides. The P atoms are cubooktaedr- or icosahedr-coordinated. Both phosphorus and metal atoms occupy the same sites.
3. As to phosphides with higher content of P, their phosphorus atoms have trigonal-prismatic or Archimed-cubic coordination.
4. New structure types are compared with the known ones.