

substance: $\text{Mn}_n\text{Si}_{2n-m}$

property: general remarks on structure, chemical bond

The structures of the Nowotny chimney-ladder compounds $\text{T}_n(\text{IV})_{2n-m}$ (T: transition element) are derived from the TiSi_2 type. The Ti atoms in orthorhombic TiSi_2 and the T atoms in tetragonal $\text{T}_n(\text{IV})_{2n-m}$ occupy a β -Sn-like array of sites with a strongly increased axial ratio c/a . The number n in the formula corresponds to the number of white-tin-like pseudocells stacked along c . According to the (IV)-deficiency the distribution of the (III)- or (IV)-atoms is stretched up along c as compared with the TiSi_2 structure [70N, 71D, 72P, 74B, 76D].

The electronegativity of the transition element is larger than that of the group IV element. Thus the T atoms act as anions so that the bonding is similar to that in the transition-element carbonyls. According to Jeitschko and Parthe [67J, 69P, 70N, 77J] semiconductor behavior and hence filled energy bands occur with 14 valence electrons per T atom.

In ternary silicides $(\text{Mn}_{1-x}\text{T}_x)_n\text{Si}_{2n-m}$ (T = Cr, Fe, Co) the silicon content depends specifically upon the second metal atom and its concentration (Fig. 1).

References:

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Fig. 1.

$(\text{Mn}_{1-x}\text{T}_x)_n\text{Si}_{2n-m}$. Silicon content vs. concentration of substitutional transition metals [68F].

