

substance: Ru₂Sn₃

property: crystal structure, chemical bond of Ru_nSn_{2n-m} compounds

The structures of the Nowotny chimney-ladder compounds T_n(IV)_{2n-m} (T: transition element) are derived from the TiSi₂ type. The Ti atoms in orthorhombic TiSi₂ and the T atoms in tetragonal T_n(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 TiSi₂ 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.

The tetragonal high-temperature structures Ru₂Si₃, Ru₂Ge₃ and Ru₂Sn₃ undergo second-order transitions to orthorhombic symmetry (D_{2h}¹⁴ – Pbcn; Z = 8) at 1300 K (Ru₂Si₃), 800 K (Ru₂Ge₃), and < 100 K (Ru₂Sn₃). Os₂Si₃ and Os₂Ge₃ are known only in the latter structure.

References:

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