**substance: $Ru_2Ge_3$**
**property: crystal structure, chemical bond of $Ru_nGe_{2n-m}$ compounds**

The structures of the Nowotny chimney-ladder compounds $T_n(IV)_{2n-m}$ (T: transition element) are derived from the $TiSi_2$ type. The Ti atoms in orthorhombic $TiSi_2$ and the T atoms in tetragonal $T_n(IV)_{2n-m}$ 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 $TiSi_2$ 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.

The tetragonal high-temperature structures $Ru_2Si_3$, $Ru_2Ge_3$ and $Ru_2Sn_3$ undergo second-order transitions to orthorhombic symmetry ($D_{2h}^{14}$ – Pbcn; Z = 8) at 1300 K ($Ru_2Si_3$), 800 K ($Ru_2Ge_3$), and < 100 K ($Ru_2Sn_3$). $Os_2Si_3$ and $Os_2Ge_3$ are known only in the latter structure.

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