Magnetic interaction in RT_xX_2 ternary compounds

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The crystal and magnetic structure of the RT_xX_2 (R – rare-earth element, T – *d*-electron element and X – *p*-electron element: Si, Ge, Sn) compounds are discussed. The factors influencing the stability of the crystal structure and the two factors which influence the stability of different magnetic structures: the magnetic interactions of the RKKY type and the crystal electric field are considered. The discussed compounds crystallize in the orthorhombic crystal structure of the $CeNiSi_2$-type. The silicides form stoichiometric compounds while the majority of germanides and stannides non stoichiometric ones. The stability of the crystal structure is determined by the radius of the X atoms (Si, Ge, Sn) and the fill up of the *3d* band of the T element. The systems discussed exhibit complex magnetic behaviour. Their magnetism arises from the interaction of the magnetic moments localized on the rare-earth ions. The large interatomic R-R distances (about 4 Å) suggest that the stability of the observed magnetic ordering scheme may be considered as being due to interactions via conduction electrons (RKKY model). The Néel and Curie temperatures determined for presented families only in part follow the de Gennes scaling. This effect suggests that the main interaction leading to the magnetic ordering in these systems is not purely of the RKKY-type but is modified by the crystalline electric field effect, which can significantly influence the magnitude of the Néel temperature. The CEF effects are also responsible for the observed decrease in the rare-earth magnetic moments as compared with the free ion values.
In conclusion the observed different magnetic structures are the results of the interaction of the RKKY type modified by the crystal electric field.

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