

Endohedral cluster intermetallics: a narrow gap between semiconducting and superconducting materials

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When transition metal is combined with excess of *p*-metal, the former is placed inside endohedral cluster with up to 14 vertices. Such clusters combine into three-dimensional frameworks leading to endohedral cluster intermetallic compounds. Peculiar chemical bonding between the transition metal in the center of the endohedral cluster and *p*-metal in its vertices in some cases can be explained through isolobal analogies to transition metal complexes [1,2]. Here, the transition metal achieves the 18-electron configuration yielding the semiconducting ground state. But in many other cases the chemical bonding is not so straightforward involving *p*-metal-based multicenter interactions and leads to variety of metallic systems. 4*d*- and 5*d*-transition-metal-based endohedral cluster compounds is a unique family, where narrow-gap semiconductors can be found very close to superconducting systems. In this talk, the Re-centred Ge, Ge/Ga, and Ga/Zn mixed clusters will be presented in the course of new intermetallic compounds with semiconducting or metallic behaviour, or even with the low-temperature semiconductor-to-metal electronic phase transition.

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