Interplay between multiple charge density waves and magnetic states in $R\mathrm{NiC}_2$ compounds

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The ternary rare-earth nickel dicarbides $R\mathrm{NiC}_2$ (R - rare earth metal) which crystallize in a non-centrosymmetric, orthorhombic crystal structure is a unique system offering an opportunity to tune the ground state with varying R atom. The charge density wave (CDW) formation related to quasi-one-dimensional electronic features and Fermi surface nesting has been found for most of the members of the $R\mathrm{NiC}_2$ family (R = Dy – Lu, Y) [1]. LaNiC_2 compound is an unconventional superconductor [2], SmNiC_2 undergoes a ferromagnetic transition [3] and the rest of the compounds (apart from nonmagnetic YNiC_2, LuNiC_2 and PrNiC_2 where only a weak magnetic anomaly is observed) order antiferromagnetically below 25 K.

The comprehensive studies on both poly- and single-crystalline $R\mathrm{NiC}_2$ compounds in terms of relations between various types of ordering will be presented here. The main emphasis will be put on the analysis of the CDW mutually interacting with magnetism as well as of the nature of multiple CDW transitions regarding the extended phase diagram of $R\mathrm{NiC}_2$ family [1]. In contrast to completely destructive influence of ferromagnetism on the CDW previously found for SmNiC_2 [3], positive impact of the magnetic anomaly on CDW in PrNiC_2 [4] and partial suppression of the CDW state by antiferromagnetic transition observed in NdNiC_2 [4], GdNiC_2 [5] and their solid solutions [6], [7] will be discussed here. For late-lanthanide-based $R\mathrm{NiC}_2$ (R = Y, Lu [8] and Tm [9]), the large positive magnetoresistance (reaching 470%), induced by the high-mobility carriers from small pockets of imperfectly-nested Fermi surface induce, will be also reported here.

References:

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