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Superconductivity and structural variation of the electron-correlated layer systems $\text{Sr}(\text{Pd}_{1-x}\text{T}_x)\text{Ge}_2$ ($\text{T} = \text{Co, Ni, or Rh}; 0 \leq x \leq 1$)\(^1\)
H.C. KU, J.W. WANG, I.A. CHEN, Y.B. YOU, C.Y. LIN, C.H. HUANG, S.J. WANG, Department of Physics, National Tsing Hua University, Y.Y. HSU, Department of Physics, National Taiwan Normal University — Superconductivity variations in the pseudoternary $\text{Sr}(\text{Pd}_{1-x}\text{T}_x)\text{Ge}_2$ layer system ($\text{Pd}(4d^8)$, $\text{T} = \text{Co}(3d^7)$, Ni$(3d^8)$, or Rh$(4d^7)$; $0 \leq x \leq 1$) are reported. For the BaFe$_2$As$_2$-type tetragonal structure, the degenerate $nd^7$ or $nd^8$ orbital of transition metal $T$ is splitted by $c$-axis squeezed $T\text{Ge}_4$ tetrahedral crystal field in the $T$-$\text{Ge}$ layer. For the isostructural $\text{Sr}(\text{Pd}_{1-x}\text{Ni}_x)\text{Ge}_2$ system, superconducting transition temperature $T_c$ decreases monotonically from 3.12 K for $4d$-band SrPd$_2$Ge$_2$ to 0.92 K for $3d$-band SrNi$_2$Ge$_2$, where major contribution of conduction electrons was from the half-filled dispersive 3D-like upper-lying $nd_{xz,yz}$ bands. For the Sr$(\text{Pd}_{1-x}\text{Rh}_x)\text{Ge}_2$ system, $T_c$ decreases to 2.40 K with 25% of $4d^7$ Rh substitution. For the Sr$(\text{Pd}_{1-x}\text{Co}_x)\text{Ge}_2$ system, $T_c$ decreases sharply to 2.58 K with only 3% of $3d^7$ Co substitution. The lower $T_c$ of the present electron-overdoped ($nd^7$ or $nd^8$) compound is due to dispersive 3D-like $nd_{xz,yz}$ conduction bands with weak electron correlation.

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H. C. Ku
Department of Physics, National Tsing Hua University

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