Rare Earth-rich Cadmium Compounds $RE_{23}T_7Cd_4$ ($T = \text{Co, Ni, Ru, Rh, Ir, Pt}$)

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The rare earth-rich intermetallic compounds $RE_{23}T_7Cd_4$ ($RE = \text{La–Nd, Sm, Gd, Tb}; T = \text{Co, Ni, Ru, Rh, Ir, Pt}$) were synthesized by melting of the elements in sealed tantalum tubes in a high-frequency furnace. They crystallize with the $\text{Pr}_{23}\text{Ir}_7\text{Mg}_4$-type structure, space group $P6_3mc, Z = 2$. The structures of $\text{La}_{23}\text{Pt}_7\text{Cd}_4$ ($a = 1025.4(2), c = 2319.5(5)\text{ pm}, wR2 = 0.0425, 2587 F^2, 74 variables$), $\text{La}_{23}\text{Ru}_{6.87(1)}\text{Cd}_4$ ($a = 1015.0(2), c = 2282.8(4)\text{ pm}, wR2 = 0.0383, 2459 F^2, 75 variables$), and $\text{Nd}_{23}\text{Rh}_7\text{Cd}_4$ ($a = 990.0(2), c = 2239.0(5)\text{ pm}, wR2 = 0.0507, 2350 F^2, 74 variables$) were refined from single crystal X-ray diffractometer data. Central structural motifs of the $RE_{23}T_7Cd_4$ compounds are transition metal-centered trigonal prisms of rare earth atoms and Cd$_4$ tetrahedra. The $RE_6T$ prisms are condensed via common edges and corners, leading to three-dimensional networks. Typical interatomic distances in the prismatic network and in the Cd$_4$ tetrahedra are 295 – 313 pm La–Pt and 319 – 325 pm Cd–Cd, respectively (examplarily for $\text{La}_{23}\text{Pt}_7\text{Cd}_4$).

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