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Rattling induced superconductivity in RV_2Al_{20} (R = Sc, Lu, Y) aluminides – an experimental and theoretical study[1] MICHAL WINIARSKI, Gdansk University of Technology, BARTLOMIEJ WIENDLOCHA, AGH University of Science and Technology, MALGORZATA STERNIK, Institute of Nuclear Physics, Polish Academy of Sciences, PIOTR WISNIEWSKI, DARIUSZ KACZOROWSKI, Institute for Low Temperatures and Structure Research, Polish Academy of Sciences, TOMASZ KLIMCZUK, Gdansk University of Technology
— Polycrystalline samples of four ternary intermetallics RV_2Al_{20} (R = Sc, Y, La, and Lu) were synthesized. Structural studies carried out using powder x-ray diffraction and Rietveld analysis show that all compounds crystallize in $CeCr_2Al_{20}$-type structure composed of icosahedral Al-R cages. Results of physical properties measurements reveal that ScV_2Al_{20}, YV_2Al_{20}, and LuV_2Al_{20} are weakly-coupled BCS superconductors with critical temperatures T_c = 1.0, 0.57, and 0.60 K, respectively. Electronic and phonon structure calculations reveal the key role of low-frequency anharmonic vibrations of R atoms (rattling effect) for the appearance of superconductivity. A correlation between phonon and crystal structures was observed, allowing to search for new RV_2Al_{20} superconductors.

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