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A. Tursina, S. Nesterenko, V. Avzuragova, A.M. Strydom

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$CeRh_2Al_{10}$ – the first rhodium aluminide with a new structure type in the 1:2:10 stoichiometry family

A. Tursina, S. Nesterenko, V. Avzuragova,

Department of Chemistry, Lomonosov Moscow State University, 119991 Moscow, Russia

A. M. Strydom

Highly Correlated Matter Research Group, Physics Department, University of Johannesburg, PO Box 524, Auckland Park, 2006, South Africa

Max Planck Institute for Chemical Physics of Solids, Nöthnitzerstr. 40, D-01187 Dresden, Germany

Abstract

A new member of the RET_2Al_{10} family was synthesized and its crystal structure was determined from single crystal X-ray diffraction. The first aluminide with rhodium adopts a new structure type of **1:2:10 stoichiometry**. $CeRh_2Al_{10}$ crystallizes in the tetragonal space group $I4_1/amd$ with cell parameters a=8.9284(11) Å and c=21.769(3) Å and is a substitution variant of $CePd_3Al_9$ compound. The mutual arrangement of Rh and Al neighbors within the 20-vertex Ce polyhedron differs in comparison with that of the $CeRu_2Al_{10}$ structure. This leads to the different packing of Ce polyhedra in the unit cell. In $CeRh_2Al_{10}$, zig-zag chains of the shortest Ce-Ce contacts extend in the two mutually perpendicular directions – along the *a*-axis and along the *b*-axis. In contrast, in $CeRu_2Al_{10}$, zig-zag chains of the shortest Ce-Ce contacts run in one direction – along the *c*-axis. We illustrate using key physical properties how the variation in crystal structure produces physical properties in $CeRh_2Al_{10}$ that differ strikingly from the situation in $CeRu_2Al_{10}$.

Keywords: A. rare earth alloys and compounds; C. crystal structure, magnetization, electrical resistivity, specific heat; D. X-ray diffraction

Introduction