# The Preparation and Crystal Structure of Ternary Rare Earth Borides, RCo_3B_2

# The Preparation and Crystal Structure of Ternary Rare Earth Borides, $RCo_3B_2$*

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## Abstract

In the ternary system of rare earth-cobalt-boron, $RCo_3B_2$ compounds (R= rare earth elements) were prepared by arc-melting methods. Their crystal structure was investigated by X-ray diffraction methods. These ternary borides, $RCo_3B_2$, crystallize in a hexagonal lattice. The lattice parameters are $a=5.020\pm0.002$Å and $c=3.027\pm0.002$ Å for $YCo_3B_2$ and $a=5.066\pm0.003$ Å and $c=3.022\pm0.002$ Å for $GdCo_3B_2$. The good agreement between the X-ray diffraction intensities observed and calculated shows that the ternary borides, $YCo_3B_2$ and $GdCo_3B_2$, crystallize in the $CaZn_5$-type structure. The space group and atomic positions are as follows: P6/mmm ($D^1_{6h}$), 1R in 1(a), 3Co in 3(g), and 2B in 2(c). It can be seen from these results that the ternary borides, $RCo_3B_2$, have a superstructure in which two Co atoms in the 2(c) site of intermetallic compounds, $RCo_5$, with the $CaZn_5$-type structure are replaced by two B atoms. The B atoms in this structure are situated at the center of a trigonal prism formed by six Co atoms. The interatomic distances between B and the six Co atoms are 2.11–2.10 Å and are fairly constant, although the radii of the rare earth atoms are changed according to the lanthanide contraction. We have also found $RCo_3B_2$ compounds to be isostructural with $YCo_3B_2$ and $GdCo_3B_2$, where R=Ce, Sm, Tb, Dy, Ho, and Er. Efforts to prepare $LaCo_3B_2$, $PrCo_3B_2$, and $NdCo_3B_2$ by arc-melting were unsuccessful.

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