The high pressure studies of crystal structure of the ErCo$_{1.95}$ and HoCo$_{1.95}$ compounds.

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The cubic RCo$_2$ compounds have attracted much attention due to some peculiar phenomena related to the metamagnetism of the Co sublattice [1]. When R is nonmagnetic (R=Y, Lu and Sc) the compound is an exchange-enhanced paramagnet exhibiting metamagnetic behavior in externally applied magnetic field. In those RCo$_2$ compounds, where R bears a permanent magnetic moment, induced cobalt moments are observed in the ordered state. The changes in the lattice constant drastically change the mechanism of the Co-moment formation at the ordering temperature between the heavy and light rare-earth containing compounds. As a hypothesis it was assumed that changing the ionic radius R tunes the molecular field acting on the Co sublattice. The tuning of lattice constant as well unit cell volume could be perform by application of high pressure. In order to clarify the crystal changes at high pressure as well equation of state obtaining we had prepare X-rays diffraction experiments at high pressure up to 4.3 GPa with ErCo$_{1.95}$ and HoCo$_{1.95}$ compounds.

In situ X-rays diffraction high-pressure experiments were carried out using the multianvil X-ray system MAX80. Diffraction patterns were recorded in an energy dispersive mode using white synchrotron X-rays from the storage ring DORIS III. The ring operated at 4.5 GeV and a positron current of 80-150 mA. The incident X-ray beam was collimated to 100 × 100 μm with a divergence smaller than 0.3 mrad. The Bragg angle 2$\theta$ was fixed at 9.093°, counting times for each diffraction pattern was 360 seconds.

![Graph](image_url)

Figure 1: The pressure dependencies of unit cell parameters of the ErCo$_{1.95}$ and HoCo$_{1.95}$. The solid lines are linear fits of experimental data.

At ambient condition, the ErCo$_{1.95}$ and HoCo$_{1.95}$ compounds has an cubic structure with space group Fd3m [2] and unit cell parameter $a = 7.1616(2)$ Å and 7.1770(2) Å, respectively. The pressure...
dependences of lattice parameters and unit cell volume of ErCo$_{1.95}$ and HoCo$_{1.95}$ were shown at fig.1 and 2. The linear compressibility $k = -(1/a_0)(da_0/dP)_T$ of unit cell parameter are $k = 0.021(2)$ for ErCo$_{1.95}$ and $k = 0.031(3)$ for HoCo$_{1.95}$.

![Pressure dependencies of the unit-cell volume of the ErCo$_{1.95}$ and HoCo$_{1.95}$ at room temperature fitted on the basis of the Birch-Murnaghan equation of state.](image)

The volume compressibility data were fitted by the third-order Birch–Murnaghan equation of state [3]:

$$P = 3/2B_0(x^{7/3} - x^{5/3})[1 + 3/4(B' - 4)(x^{-2/3} - 1)],$$

where $x = V/V_0$ is the relative volume change, $V_0$ is the unit cell volume at $P = 0$; $B_0$ and $B'$ are the bulk modulus $B_0 = -V (dP/dV)_T$ and its pressure derivative $B' = (dB_0/dP)_T$. The calculated values for cubic phase of the ErCo$_{1.95}$ and HoCo$_{1.95}$ are $B_0 = 99.6(8)$ and $154(2)$ GPa, respectively.

**References**