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The magnetic properties of intermetallic cobalt compounds under high pressure

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The study of YCo5-xMx (M = Fe, Co, Ni) intermetallides is one of the actual task of condensed matter physics, due to the large variety of physical phenomena found in materials based on them. Such phenomena as the magnetism of collectivized electrons, giant magnetoresistance, magnetocaloric effects (FEM), and the volume collapse of the crystal lattice were found in these compounds, which makes them promising materials for magnetic refrigerators, permanent magnets, etc.
The RCo5 and YCo5-xMx compounds crystallize in CaCu5-type structure with space group P6/mmm. In this lattice, the cobalt atoms occupy 2c and 3g sites and form ferromagnetic ordering. These compounds are sensitive to changes in interatomic distances that can lead to significant changes in their magnetic properties and the simultaneous using of high-pressure cells give opportunity to control the changes of the interatomic distances.
In our work the results of the investigation of YCo5 and YCo4Si by the method of neutron diffraction at high pressures are presented. The crystal structure and magnetic properties of YCo5 compound have been studied by neutron diffraction, in the pressure range $0 \le p \le 7.2$ GPa at room temperature. A lattice collapse is detected due to a change of cobalt ions spin states from the high spin to the low spin in YCo5. YCo4Si have been studied in a wide range of pressures and temperatures $0 \le p \le 5.3$ GPa and $10 \le T \le 300$ K, respectively. The Curie temperature reducing with same baric coefficients -10 K/GPa for cobalt atoms in both 2c and 3g positions is observed under pressure. The suppression of cobalt magnetic moments in these positions has been found as well. This phenomena is associated with change of cobalt ions spin states from the high spin to the low spin in YCo4Si.

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