Disorder Induced Modification of Phase Diagram in Frustrated One-dimensional Magnetic Chain Compound $Ca_3Co_{2-x}Rh_xO_6$

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In recent years the magnetic properties of Ca3Co2O6 and Ca3CoRhO6 have generated much interest. These compounds belong to hexagonal perovskite-type oxides. Ca3Co2O6 Consists of the (Co2O6)∞chains separated by Ca atoms. Each (Co2O6)∞ chain has CoO6 octahedra alternating with CoO6 trigonal prisms of sharing their triangular face. The intrachain coupling is ferromagnetic with transition temperature Tc1=24K and the interchain antiferromagnetic with a transiton temperature of Tc2=12K. Owing to an interchain magnetic frustration associated with the triangular lattice, the magnetic ground state is either a partially disordered antiferromagnetic state or a spin-freezing state. Substitution of Co by Rh. The structure of Ca3CoRhO6 results from that of Ca3Co2O6 by replacing the CoO6 octahedra with RhO6 octahedral. Ca3CoRhO6 compound has its Tc1 shifts up to a high value of 90K and Tc2 to 35K. We report studies of intrachain cation ordering disorder on the magnetic properties of the Ca3CoRhO6 compound. We tried two kind of method to lead in cation disorder. First, Ca3CoRhO6 compound get modified by partial Rh or Co composition, Ca3Co2-xRhxO6(x=0.75, 1.25). Second, disorder was produced in a controlled manner sintering/annealing the compound at temperature 1260℃ followed by cooling at various rate each sample(air quenching, 2.0K/min, 0.5K/min). It is found that cation disorder (and grain size decreses) with increasing cooling rate. Magnetization was measured by a PPMS(Quantum design). And Powder Neutron diffraction data were colleted with an high resolution neutron powder diffractometer at the HANARO reactor, KAERI.