

Structural and magnetic properties of Co_2MnSi based half-metals

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The $\text{Co}_2\text{Mn}_{1-x}\text{R}_x\text{Si}$, where R=Gd or Tb and $x=0, 0.01, 0.05$ and 0.1 were prepared. The crystal structure was checked by X-Ray, TEM, SAED and EDS. Magnetic measurements in fields up to 12 T and temperature range 4.2-700 K were performed.

X-ray studies revealed, in the limit of experimental errors, that the L21 structure is preserved. The TEM images and SAED shows that small, approximately 1 micrometer long, inclusions are formed in isolated places. EDS analysis, revealed a higher amount of Mn in the inclusion than in the bulk in the sample with Gd. The inclusions are non-magnetic and approximately homogeneous dispersed, and therefore are not influencing the magnetic properties of the alloys.

In the case of the compounds with Tb, the EDS results suggest that Tb is not substituting the Mn atoms. A second phase consisting on nanometer size needle structures was revealed.

All the samples are saturated in an external magnetic field of 3T. For example the magnetic moment at 4.2 K decrease from $5.07 \mu_B/\text{f.u.}$ for undoped $\text{Co}_2\text{Mn}_{1-x}\text{Gd}_x\text{Si}$ to 4.75 for $x=0.01$ and $4.53\mu_B/\text{f.u.}$ for $x=0.05$ suggesting an antiparallel coupling of rare earth and Mn magnetic moments.

9.7 cm

13.4 cm

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