MAGNETIC PHASE TRANSITION IN $PrMn_{2-x}T_xGe_2$ (T=Co AND Cr)

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The intermetallic ternary RMn_2X_2 compounds, where R is a rare-earth element, T is a transitional metal and X is Si or Ge, crystallize in the body-centered tetragonal $ThCr_2Si_2$-type structure. In the RMn_2X_2 compounds, the Mn atoms carry a magnetic moment, long-range ordering of Mn moments occurs. The magnetic properties of RMn_2X_2 compounds are very sensitive to the Mn-Mn interatomic distance dMn-Mn within the (001) Mn layer. The relation between intralayer Mn-Mn distance and the type of magnetic order in the Mn-layers for RMn_2X_2 can be summarized follows: 1- dMn-Mn < 2.84 Å (a < 4.02 Å). Intralayer in-plane antiferromagnetic alignment; interlayer ferromagnetic alignment. 2- 2.84 Å < dMn-Mn < 2.87 Å (4.02 Å < a < 4.06 Å): intralayer in-plane antiferromagnetic alignment; interlayer antiferromagnetic alignment. 3- dMn-Mn > 2.87 Å (a > 4.06 Å): no intralayer in-plane component; interlayer antiferromagnetic alignment. When Mn is substituted by other 3d elements in RMn_2X_2, the Curie and Neel temperatures associated with the Mn sublattice decrease with increasing amount or transitional metal solute. In this work, we report on the relationship between the crystal structure and Mn magnetism in the $PrMn_{2-x}T_xGe_2$ (T = Co and Cr) series, studied by X-ray diffraction and magnetic measurements to elucidate the influence of the transitional metal radius. For the samples with x = 0.8, cooling from a temperature within the antiferromagnetic state at TCinter < T < TNintra and through TCinter in an applied magnetic field prepares the ferromagnetic components of the sample with a preferred orientation. This orientation is pinned by the antiferromagnetic anisotropy.

Keywords: RARE-EARTH MAGNETISM, PINNING, LAYERED MAGNETIC STRUCTURES

EFFECTS OF STRUCTURAL ORDERING IN $La_{1-x}Ca_xMnO_{3-y}$ THIN FILMS

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Powder samples and thin films of $La_{1-x}Ca_xMnO_{3-y}$ (LCMO) were analyzed by an X-ray diffraction method. The solid-phase synthesis method was used to make LCMO powder samples with x=0.125,0.333,0.5. To receive LCMO thin films $La_{1-x}Ca_xMnO_{3-y}$ was deposited on $LaAlO_3$ (LAO) and α-Al_2O_3 (AO) substrates. Chemical consistence of these films was controlled by an X-ray fluorescent analysis. In this work the following problems have been accomplished:
was the short range order in La and Ca location obtained in perovskite structure?
do the dimensional effects appear in the bulk samples and thin films?
is there any difference in structures and characteristics of LCMO thin films deposited on various substrates?
what kind of order parameter describes phase transitions in the analyzed LCMO compounds?
The short range order in La and Ca location was found in polycrystalline samples of LCMO (x=0.125,0.333,0.5). This fact was determined by an x-ray diffusive dispersion and pair distribution function [1]. It was found that LCMO thin films have single-crystal structure and their lattice constants depend on the substrates structure. The LCMO structure changing depending on x and samples temperature can be described by order parameter similarly in [2] for high temperature superconductor $YBa_2Cu_3O_{7-y}$ (YBCO).
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Keywords: **SHORT RANGE IN CMR THIN FILMS**

FIELD AND PRESSURE EFFECTS ON CORRELATIONS ASSOCIATED WITH CHARGE-ORBITAL ORDERING IN MANGANITES

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Doped perovskite-type manganese oxides have attracted much interest because of the colossal magneto-resistance and charge-and-orbital ordering (COO) phenomena. Recent diffuse scattering experiments have revealed the existence of the lattice polaron and their short-range incommensurate correlation.
We have conducted X-ray scattering measurements to study the magnetic-field effects on the short-range and long-range COO in $Pr_{0.65}Ca_{0.35}MnO_3$ and $Nd_{0.52}Ca_{0.48}(Mn_{0.98}Cr_{0.02})O_3$. In both crystals, the intensity of the incommensurate peak decreases monotonically with increasing field above the COO transition temperature. This field dependence of the intensity is very similar to that of the resistivity. The correlation length is almost independent of magnetic field. These results may suggest that the short-range ordered region decreases heterogeneously with increasing field. The field induced phase transition from the insulating COO phase to the disordered metallic phase was observed at low temperatures. In the Cr-doped crystal, the COO phase exhibits the incommensurate structure near the transition fields where two phases coexist. The fractional volume of the COO region was found to depend on annealing fields.
We have measured the temperature and pressure dependences of the super-lattice reflections attributed to the COO in $Pr_{0.65}Ca_{0.35}MnO_3$. The super-lattice reflection disappears above 2 GPa, and this indicates that the COO phase is transformed into the ferromagnetic metallic phase. We found an indication of an additional phase transition in a limited region of pressure and temperature where the intensity shows an anomalous increase. A pressure-temperature phase diagram was obtained from these results.

Keywords: **MANGANITE POLARON CHARGE ORDERING**

CHARACTERISTIC OF SUPERSTRUCTURAL ORDERING IN NATURAL NONCRYSTALLINE SUBSTANCES

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In different types of natural noncrystalline substances the supermolecular organization frequently is found. As a rule it has, visually a chaotic character, and was earlier evaluated qualitatively. The receiving of the quantitative structural information about of the supermolecular organization is the important problem because its influence on the physical-chemical properties of the substances and its dependence on location geological conditions and formation processes.
In the present work the supermolecular organization of the noncrystalline solids of the natural origin is characterized on the example of the row natural colloids of the various composition and genesis. As samples we used noncrystalline carbon of shungite deposits (Karelia), yttrium phosphate, precious and worthless opals, native gold. Tunneling and atomic-force microscopy was used for superstructure visualization. For the superstructural ordering analysis the combination of methods were used to determine as availability of the comparatively simple (periodic) ordering type, as more complicated (fractal) order type.
The morphological diffractional analysis of the researched substances has confirmed visually observable deficiency of the periodic order in the mutual disposition of supermolecular structure elements. For quantitative description of non-periodic aggregates structures, in particular, colloid ones methods of fractal geometry are applied. The certain values of the fractal dimensions were obtained for superstructural organization of the investigated natural noncrystalline substances. On this evidence it is supposed, that globular superstructure of the natural noncrystalline substances can be described by fractal dimension.

Keywords: **AFM, SUPERMOLECULAR ORDERING, AMORPHOUS SUBSTANCES**