FIRST-ORDER MAGNETIC PHASE TRANSITIONS

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After the general properties of the first-order magnetic phase transitions between ordered structures were investigated, the number of possible models has been limited by supposing the sensitivity of the exchange energy to the interatomic distance to be responsible for the phase transition. It has shown that the magnetic phase transition occurs as a result of a sign-change in the proper combination of the exchange parameters. The transition may be influenced by the variation of the pressure and the magnetic field. The actual phase transition is, however, hindered in both directions by the elastic energy wall, separating the free energy minima of the different phases. The $T - P$ phase diagram has been calculated and the conditions for the existence of a triple point in the $T - P$ plane have been investigated in the case of antiferromagnetic ↔ ferromagnetic transitions. The temperature hysteresis, i.e. the difference between the upper (T_{sup}) and lower (T_{inf}) transition temperatures has been determined at different pressures and for both temperatures a linear dependence has been obtained.

The $T - H$ coexistence curve between the ferromagnetic and the spin-flop antiferromagnetic phases has been determined. The upper and the lower phase transition temperature versus magnetic field curves were calculated and was is found that with increasing magnetic field and decreasing temperature the difference between these two curves (i. e. the hysteresis width) becomes increasingly small until at a critical field (H_t) and temperature (T_t) they end in a common point with the coexistence curve. Below T_t the variation of the magnetic field does not lead to a first-order antiferromagnetic ↔ ferromagnetic transformation. The ferromagnetic phase is nothing, but the antiferromagnetic phase in a magnetic field is strong enough to turn the moments parallel to the field direction. Above H_t but below H_i the variation of the temperature brings about also a second-order ferromagnetic ↔ antiferromagnetic transition.

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