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Magnetic frustration in M-Fe-V-O system

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Vanadium compounds from the M-Fe-V-O (M (II) = Zn (II), Mg (II), Cu (II), Mn (II) and Co (II)) system containing magnetic and nonmagnetic ions in the cationic sublattices exhibit structural randomness (iron ions could occupy different positions of ions M(II)). Oxygen deficiency observed in these compounds may be responsible for the emergence of competing magnetic interactions which prevent the formation of long-range magnetic order at high temperatures. Study of the temperature dependence of magnetic susceptibility and electron paramagnetic resonance (EPR) spectra of compounds from the M-Fe-V-O system has revealed the presence of significant spin frustration. It may be due to the Fe^{3+} ions located in cationic sublattices. Magnetic measurements of these systems showed the existence of strong antiferromagnetic interaction at high temperatures with high value of the Curie-Weiss temperature. Competing magnetic interactions allow to formation of long range magnetic order only at low temperatures. In particular, the static magnetic susceptibility for the $M_2FeV_3O_{11}$ (M(II)= Zn(II) and Mg(II)) compounds has revealed the existence of antiferromagnetic interaction between the Fe^{3+} spins with the Curie-Weiss temperature of θ = -55 K and the phase transition to a spin glass state at T_f = 2.5-2.8 K. Strong changes of the EPR parameters were observed at about 50 K. Similarly, in $M_3Fe_4V_6O_{24}$ compounds the high-temperature long-range magnetic order was not registered. For these compounds the Curie-Weiss temperature is high. Competition and frustration of magnetic processes may be responsible for the lack of long-range order at high temperatures despite the presence of a strongly coupled correlated spin system.