substance: V_2O_3
property: magnetic properties

Magnetic susceptibility for V_2O_{3+x}: Fig. 1. V_2O_3 is antiferromagnetically ordered below 155 K, with spin structure shown in Fig. 6 [81W]. The spins are ordered in (010) planes of monoclinic cell or (110) hexagonal plates with moments canted at 71° to the *c*-axis [75M].

exchange constants and anisotropy

J_α	– 27.2 meV	81W
J_β	45.9 meV	
J_γ	– 23.2 meV	
J_δ	2.81 meV	
J_ε	– 4.76 meV	
A_u	9.51 meV	

magnon dispersion: Fig. 2. Effective magnetic moment in the monoclinic phase is 1.25 μ_B for the V^{3+} ion [70H] or 1.2 μ_B [70M]. The magnetic susceptibility in the semiconducting phase ($T < T_{tr}$) is highly anisotropic [71G]. For p_{eff}, χ_m and C_m, see also magnetic data for V_nO_{2n-1} compounds. For $T > T_N$ (= T_{tr}) the susceptibility is given by $\chi \approx \chi_0 + C/(T-\Theta_p)$ with $\chi_0 = 2.8 \cdot 10^{-6}$ cm^3 g^{-1} and

C	0.00926 cm^3 K g^{-1}	$T < 400$ K, $\chi_\perp$		68A
Θ_p	– 649 K			
p_{eff}	2.352 μ_B			
C	0.00922 cm^3 K g^{-1}	$T < 400$ K, $\chi_\parallel$	a small magnetic anomaly is	
Θ_p	– 660 K		reported in $\chi_\parallel$ at 518 K	
p_{eff}	2.347 μ_B		[77P, 78K]	
C	0.01134 cm^3 K g^{-1}	$T > 500$ K, $\chi_\perp$		
Θ_p	– 743 K			
p_{eff}	2.603 μ_B			
C	0.01183 cm^3 K g^{-1}	$T > 500$ K, $\chi_\parallel$		
Θ_p	– 740 K			
p_{eff}	2.659 μ_B			

magnetic phase diagrams: for V_2O_{3+x}, see Fig. 5; combined magnetic phase pressure/composition diagram for V_2O_3:Cr and V_2O_3:Ti, see Fig. 3; for V_2O_3–Cr_2O_3 system, see Fig. 4; magnetic data, see [71G].

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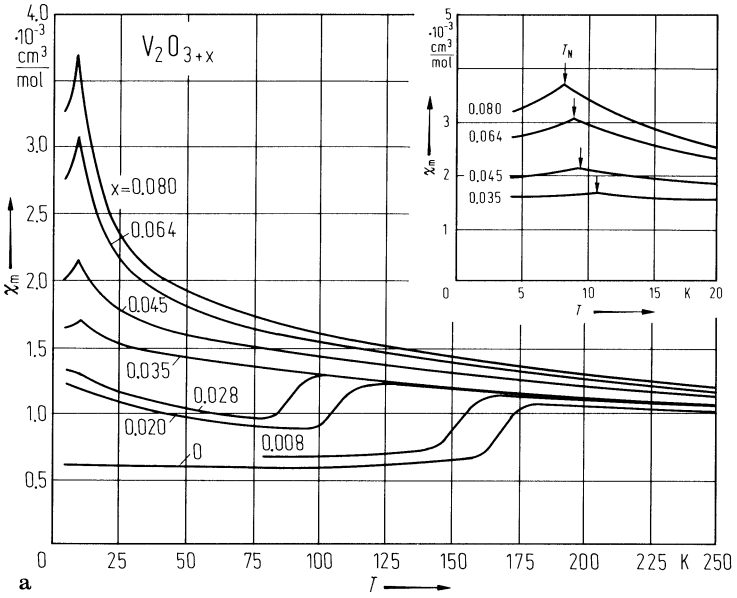
Fig. 1.

V_2O_{3+x}. (a) Magnetic molar susceptibility below 250 K. For x > 0.035 no AF-M transition is seen. (b) Magnetic molar susceptibility above 300 K. The upper transition becomes smeared out at x > 0.04 [80U]. χ_m in CGS-emu. Orientation χ_m not given.



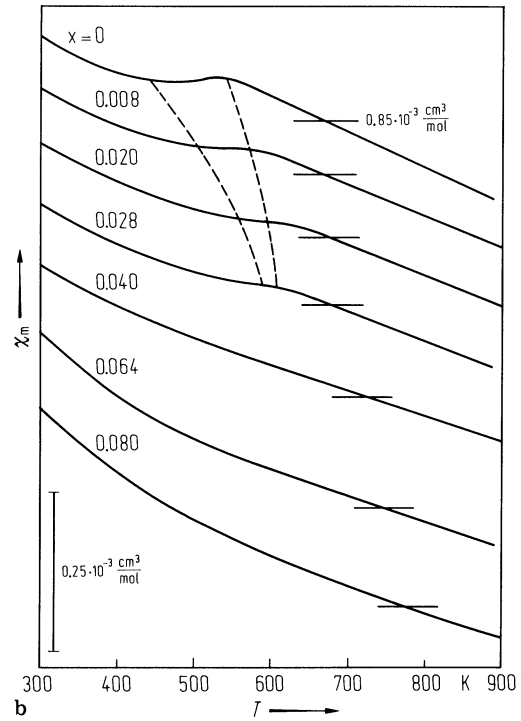


Fig. 2.

V_2O_3. Computed magnon dispersion curves [81W].

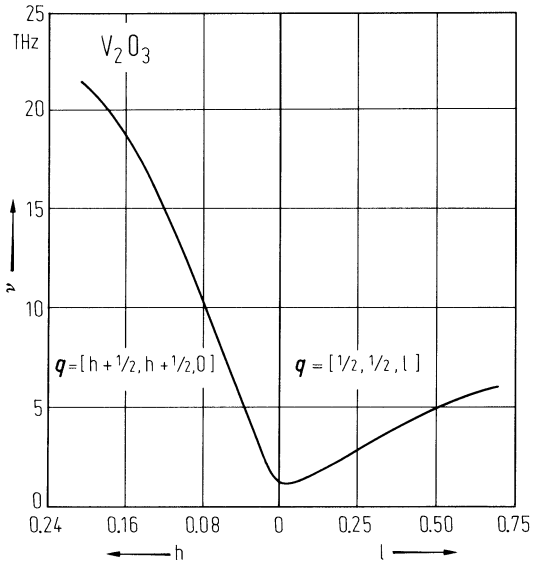


Fig. 3.

$(V_{1-x}M_x)_2O_3$. Generalized phase diagram for the AF – M transition vs. doping with Cr and Ti and vs pressure. Lower abscissa: increasing pressure 4 kbar/division, zero pressure point moves with top scale [80U].

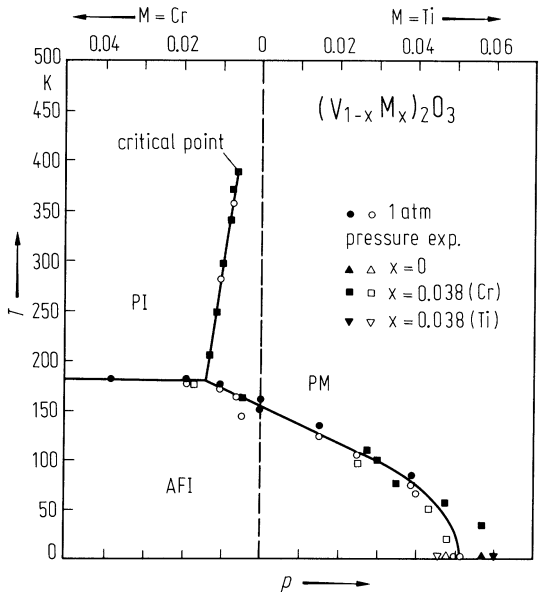


Fig. 4.

$(Cr_xV_{1-x})_2O_3$. Phase diagram defined by magnetic and crystallographic boundaries. Full lines by neutron diffraction, dashed line shows the metal-insulator boundary, which is also defined by crystallographic discontinuity. P: paramagnetic, AFM I: Cr_2O_3-type magnetic order, AFM II: new type of corundum magnetic ordering, AFM III: monoclinic V_2O_3, M: metallic conduction, corundum lattice [72R].

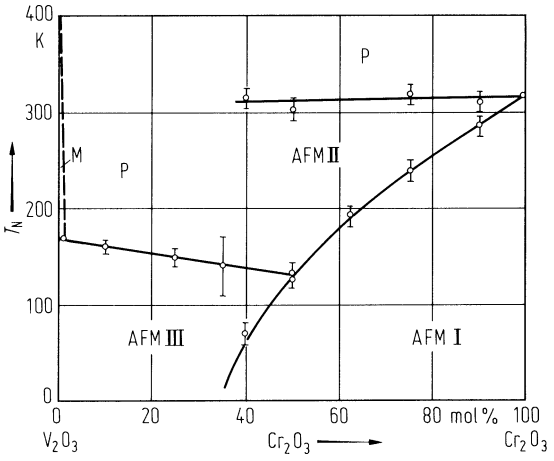


Fig. 5.

V_2O_{3+x}. (Magnetic) phase diagram obtained from experimental results [80U]. PI: paramagnetic insulator, PM paramagnetic metal, AFI: antiferromagnetic insulator AFM: antiferromagnetic metal. Hatched area shows region where the upper transition is seen.

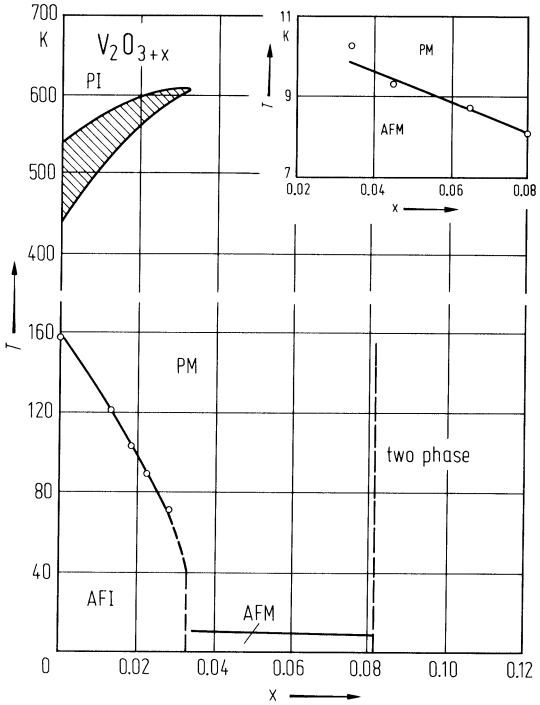


Fig. 6.

V_2O_3. Relationships between V-atoms in hexagonal, rhombohedral and monoclinic unit cells. The primitive rhombohedral axes are shown as bold lines in (a). The magnetic and crystallographic unit cells are shown in (b). Spins on the filled circles are opposite to those on the open circles. Assuming equivalent metal atoms, the magnetic monoclinic cell is half (a'_m = 1/2 a_m) of the crystallographic cell. [81W]. J_α...J_ε are magnetic coupling constants.