Study of the crystalline and nagnetic structure of half-Heusler compounds $MnNi_{0.9}M_{0.1}Sb$ (M = Ti, V, Cr, Fe, Co, Zn) at high pressures and low temperatures

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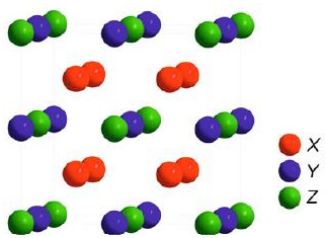
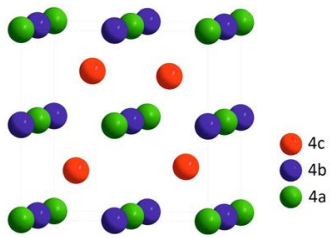
Heusler compounds

Heusler and Half – Heusler alloys

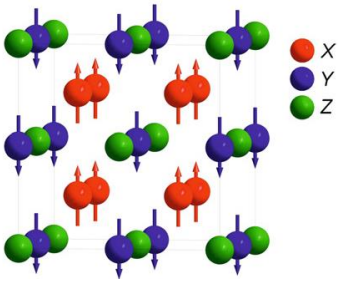
Cubic structure

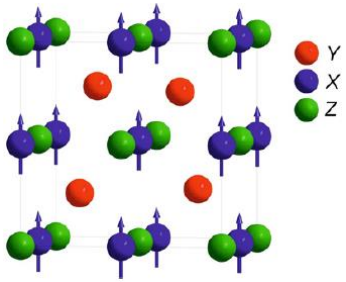
X_2YZ	XYZ
$Fm\bar{3}m$	$F\bar{4}3m$
Ni_2MnSb, Cu_2MnAl	NiMnSb; CuMnSb



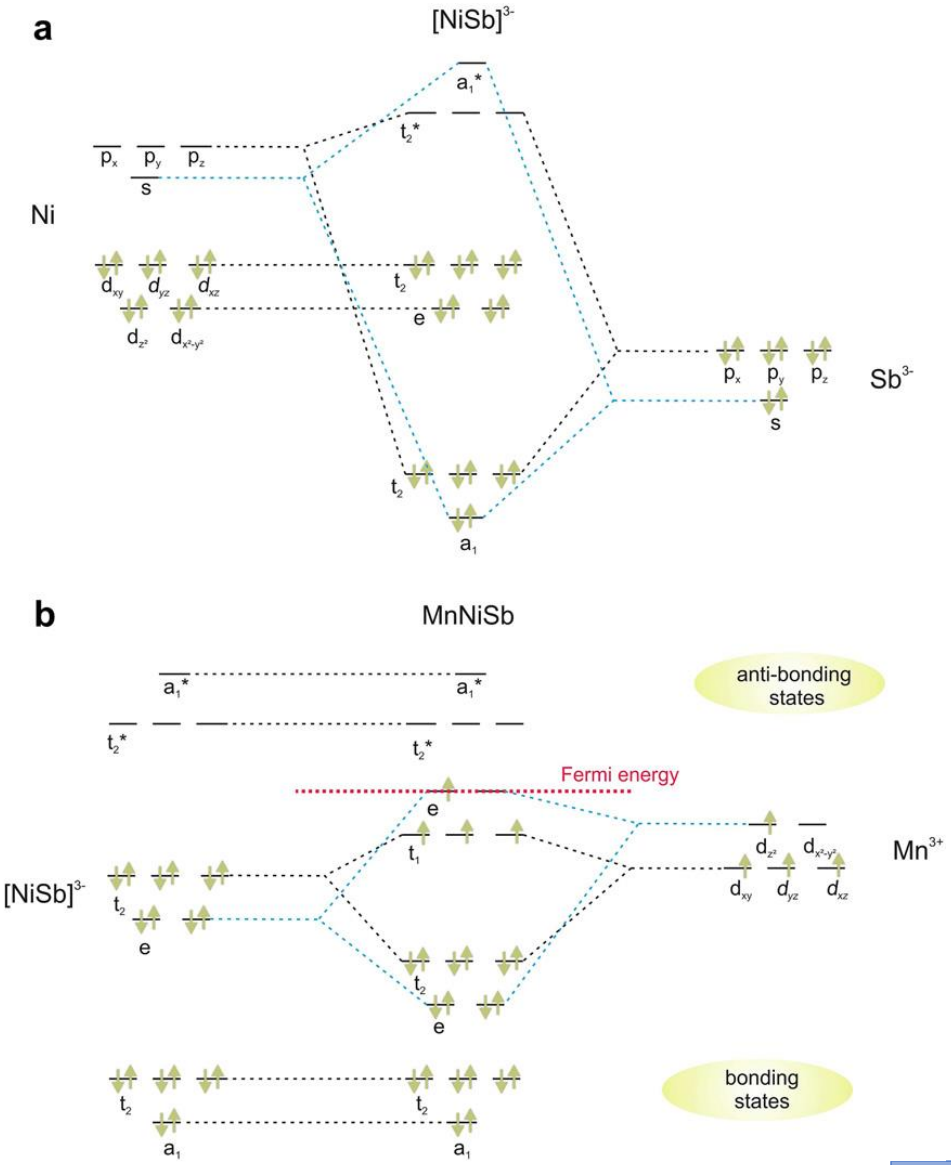


X_2YZ Magnetic structure XYZ

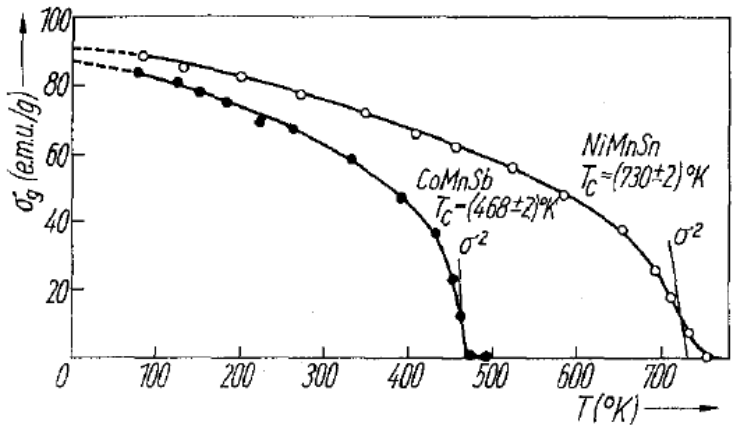




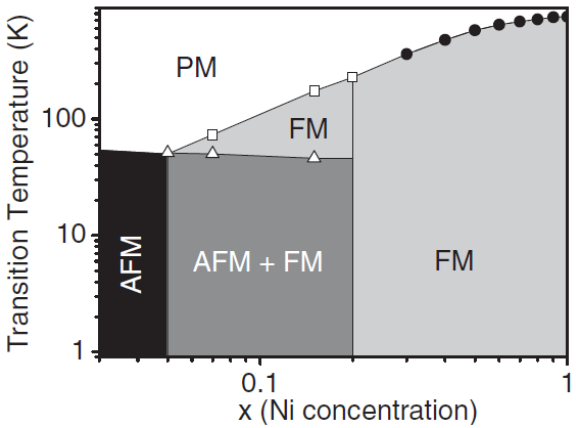
Ni
Mn
Sb



Magnetic properties of Half-Heusler compounds

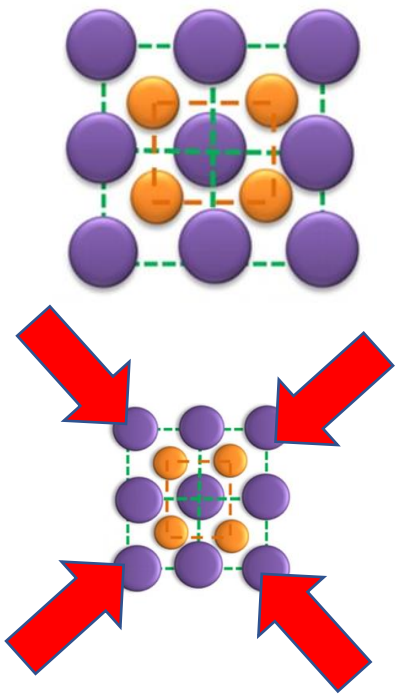


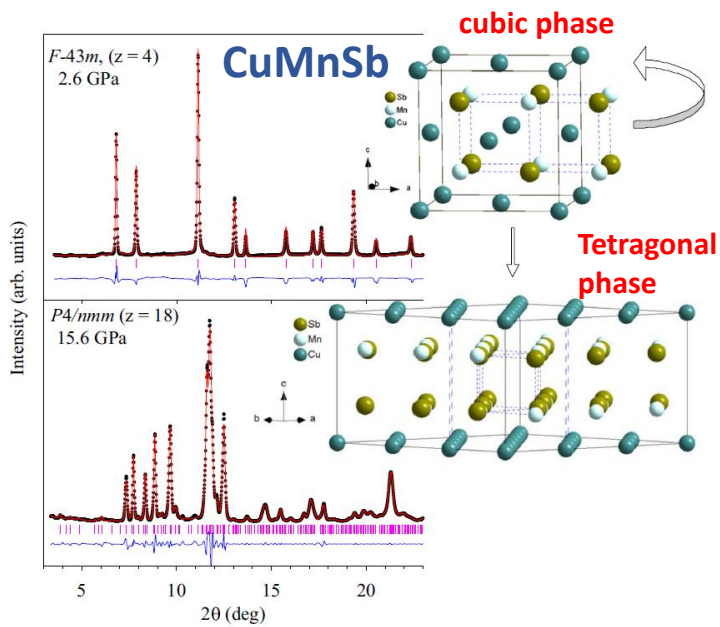
phys. stat. sol. (a) **9**, 97 (1972)

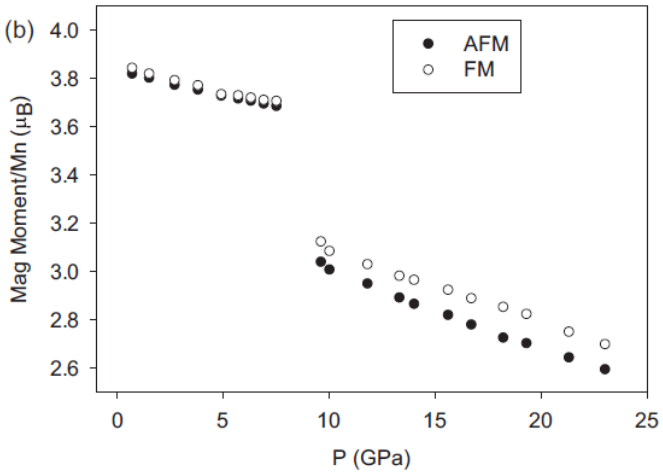


Magnetic phase diagram of the $Cu_{1-x}Ni_xMnSb$ Heusler alloys series from x = 0.03 to 1. PHYSICAL REVIEW B **84**, 094435 (2011)

Half-Heusler alloys under pressure







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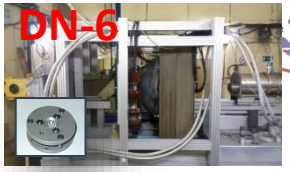
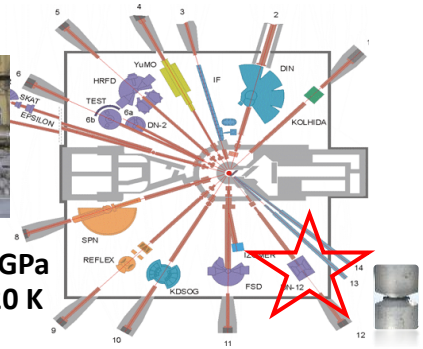
Neutron and X-ray diffraction techniques under extreme conditions

Neutron diffractometers at IBR-2 reactor

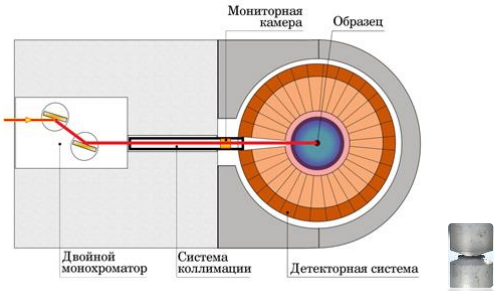


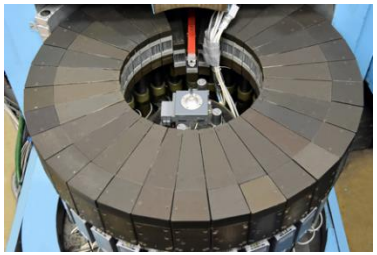


Maximum pressure ~ 35 GPa
Temperature range 4 -320 K

Maximum pressure ~ 8 GPa
=80 000 atm.
Temperature range 10 -320 K

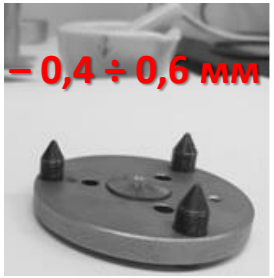
DISC neutron diffractometer at IR-8 research reactor



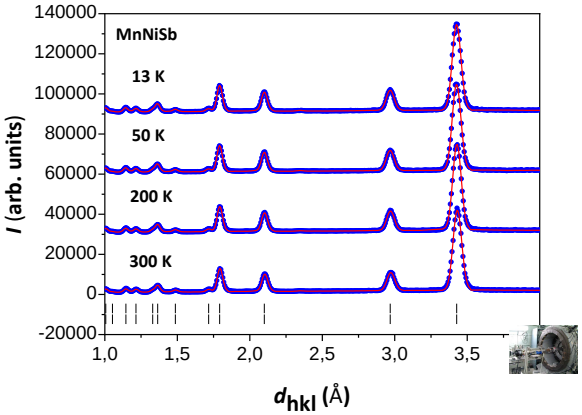


Maximum pressure ~ 3 GPa
Temperature range 3 -320 K

X-ray diffractometer

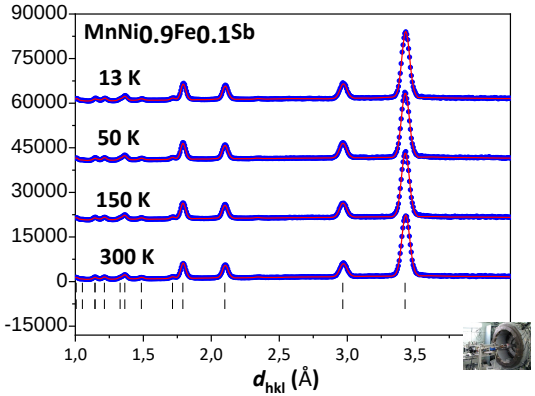


MnNiSb and $MnNi_{0.9}M_{0.1}Sb$ (M=Fe, Ti, V) at low temperature



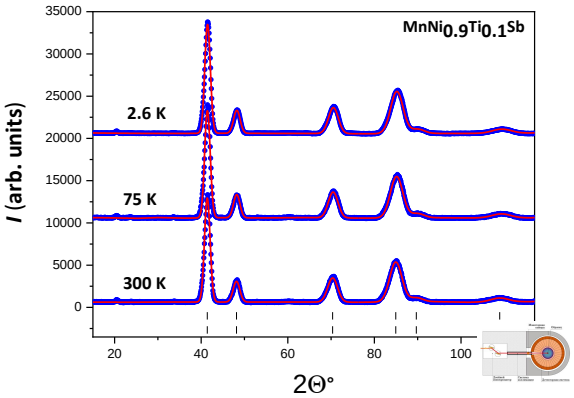
T = 300 K M = 3,8 μ_B

T = 13 K M = 4,1 μ_B



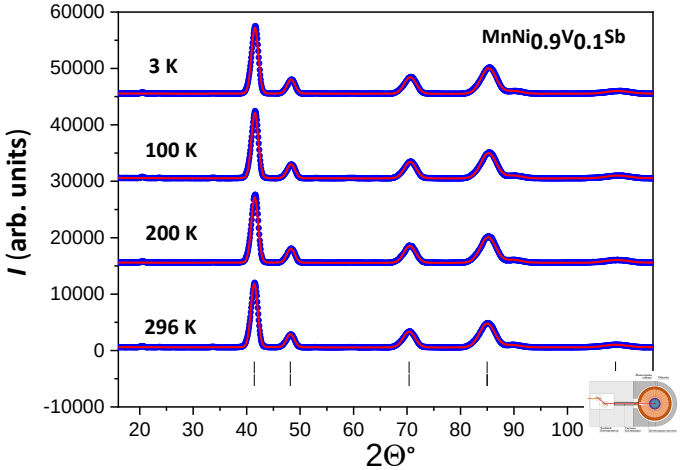
T = 300 K M = 3,5 μ_B

T = 13 K M = 4,0 μ_B



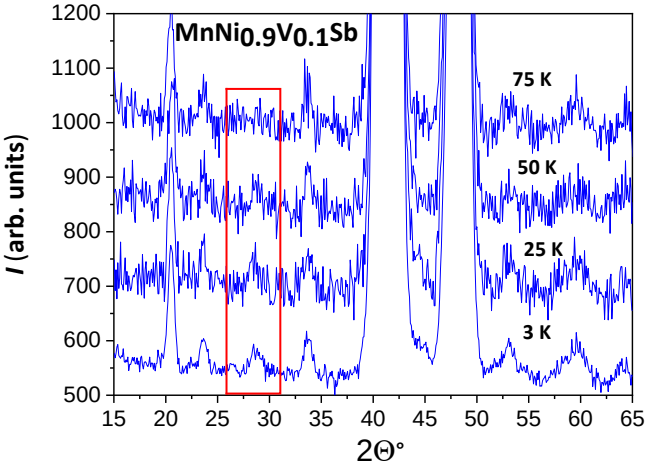
T = 300 K M = 3,4 μ_B

T = 2,6 K M = 3,7 μ_B

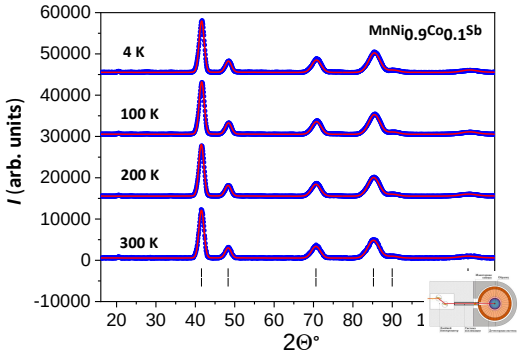


T = 300 K M = 3,5 μ_B

T = 3 K M = 3,8 μ_B

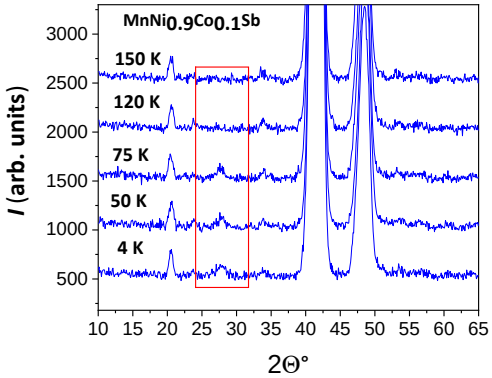


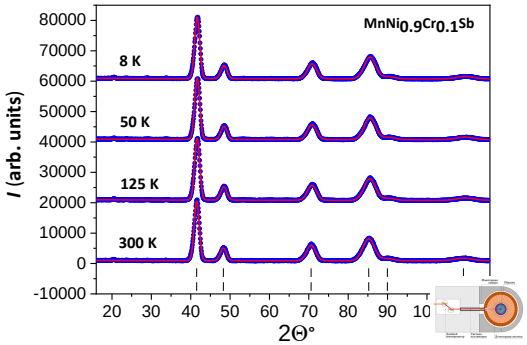
$MnNi_{0.9}Co_{0.1}Sb$ and $MnNi_{0.9}Cr_{0.1}Sb$ at low temperature



T = 300 K M = 3,6 μ_B

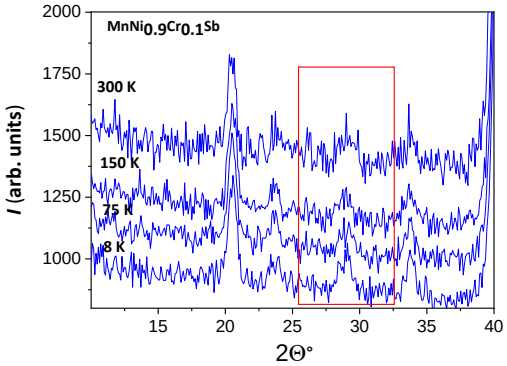
T = 4 K M = 4,1 μ_B

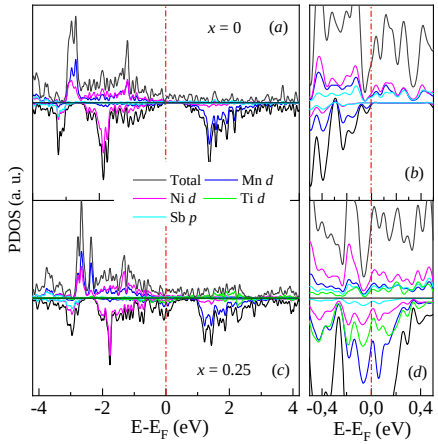


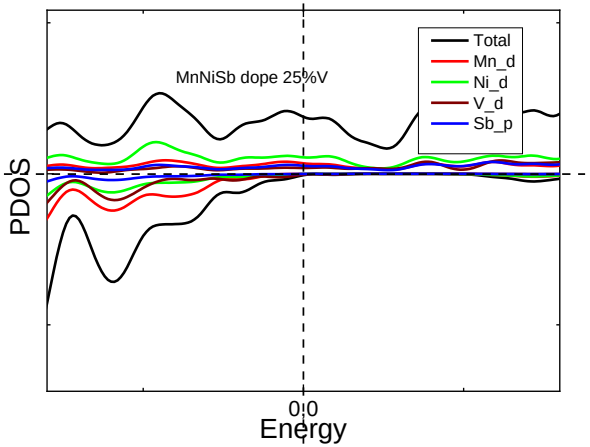


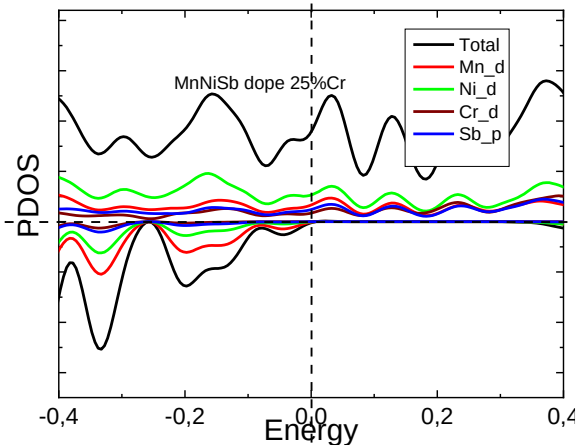
T = 300 K M = 3,7 μ_B

T = 8 K M = 4,1 μ_B









Ti = 12,5 % M = 0,7 μ_B

Ti = 25 % M = 0,8 μ_B

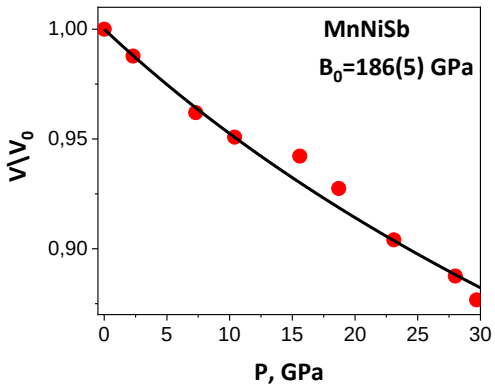
V = 12,5 % M = 1,7 μ_B

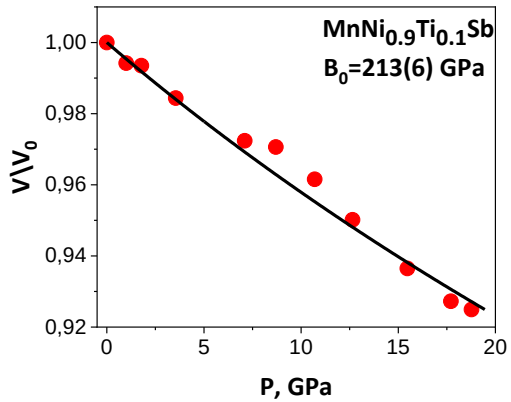
V = 25 % M = 1,8 μ_B

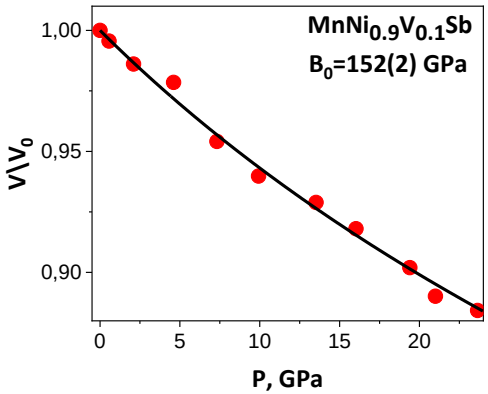
Cr = 12,5 % M = 2,5 μ_B

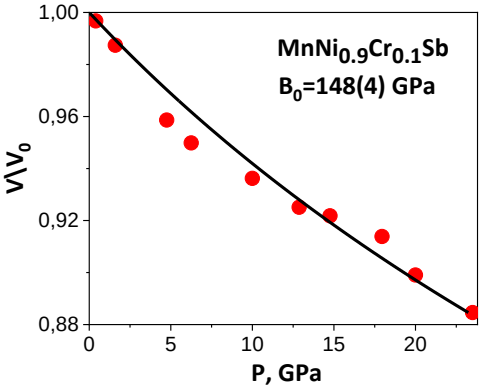
Cr = 25 % M = 2,5 μ_B

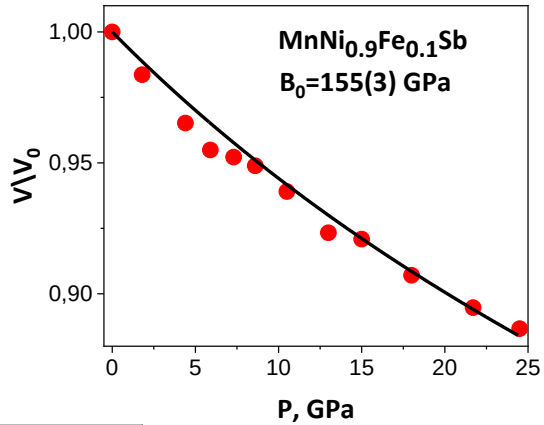
MnNiSb and $MnNi_{0.9}M_{0.1}Sb$ (M – Ti, V, Cr, Co, Fe, Zn) under high pressure

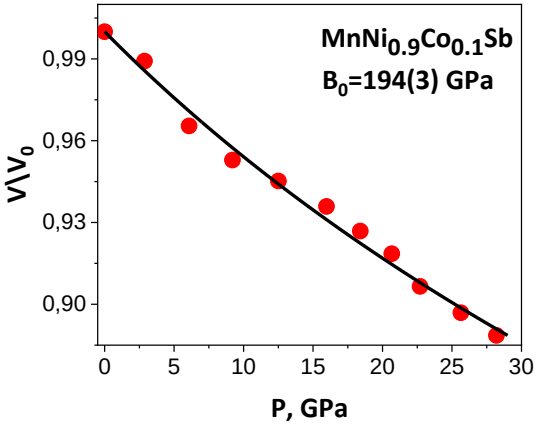


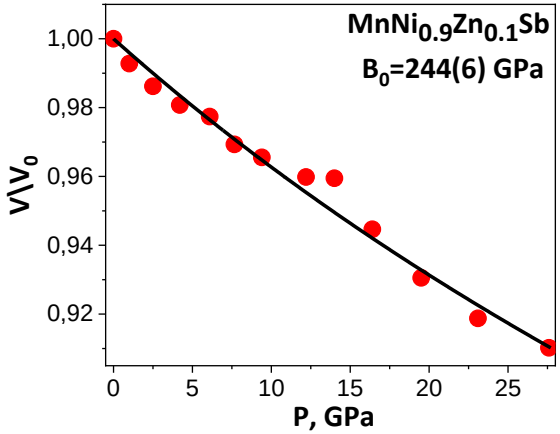


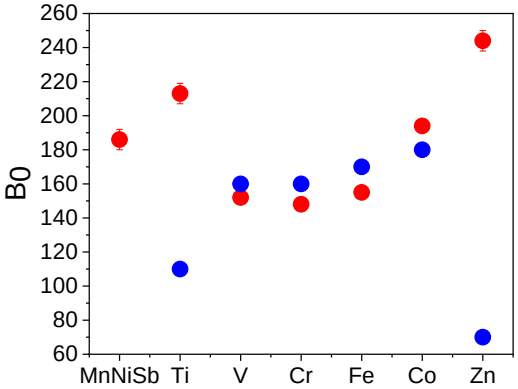












Thank you for your attention!