substance: Mn_nSi_{2n-m}
property: physical properties of doped and ternary Mn_nSi_{2n-m} phases

For lattice parameters, see document .

Solubility limits

$MnSi_{1.73-x}B_x$	$x < 0.06$		70N
$MnSi_{1.73-x}Al_x$	$x \leq 0.006$		70N
$MnSi_{1.73-x}Ge_x$	$x \leq 0.015$		70N, 72A
$(Mn_{1-x}Cr_x)_nSi_{2n-m}$	$x < 0.05$		70U
	$x \approx 0.09$	at 1000°C	72A
$(Mn_{1-x}Re_x)_nSi_{2n-m}$	$x < 0.07$		69E, 70U
$(Mn_{1-x}Fe_x)_nSi_{2n-m}$	$x = 0.25$		74A
	$x \leq 0.30$		70N

The solubility of B and Al in $Mn_{11}Si_{19}$ is increased by at least an order of magnitude by the presence of Ge. Doping with Ge slightly raises the conductivity, but does not affect the thermoelectric power. Alloying with boron increases the concentration of charge carriers without markedly reducing their mobility. Partial substitution of Si by Al results in a greater high-temperature conductivity.

Cr substitution for Mn, which reduces the valence-electron concentration but increases the (intrinsic?) conductivity and the slope of log σ vs. T^{-1} [72A], leads to a smaller defect, i.e. to a smaller value of (2n–m)/n while the reverse holds for Fe substitution [70N]. Fe substitution for Mn increases the low-temperature resistivity, the carrier concentration and the effective mass m_p and reduces the mobility and the thermal conductivity in [100] direction. The anisotropy of S and σ decreases with temperature and vanishes toward 1000 K [74A] (Figs. 1...5).

References:

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Fig. 1.

$Mn_{1-x}Cr_xSi_{\approx 1.7}$ and $Mn_{1-x}Fe_xSi_{\approx 1.7}$. Electrical conductivity σ and thermoelectric power S vs. concentration x [71N]. a: S for samples with variable Si contents, b: S for $Mn_{1-x}Fe_xSi_{1.73}$.

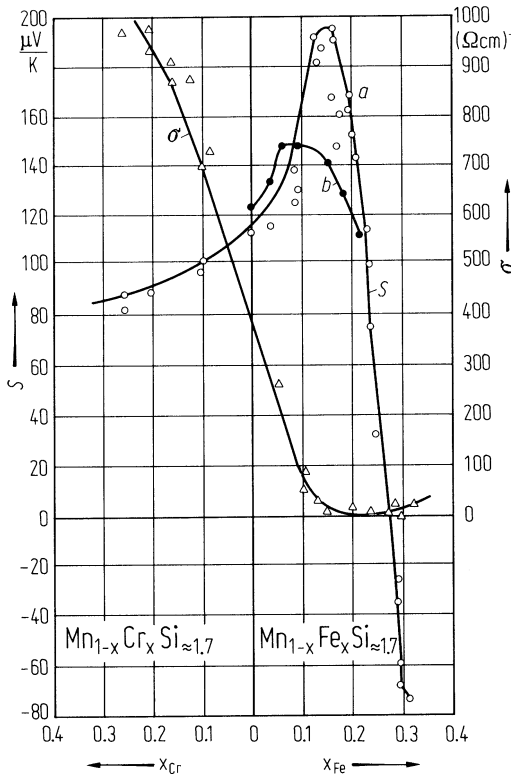

Fig. 2.

$Mn_{1-x}Fe_xSi_{\approx 1.7}$ Electrical conductivity vs. reciprocal temperature [75Z]. *1*: x = 0, *2*: x = 0.1, *3*: x = 0.15, *4*: x = 0.17, *5*: x = 0.21, *6*: x = 0.23, *7*: x = 0.24, *8*: x = 0.25, *9*: x = 0.28, *10*: x = 0.29, *11*: x = 0.30.

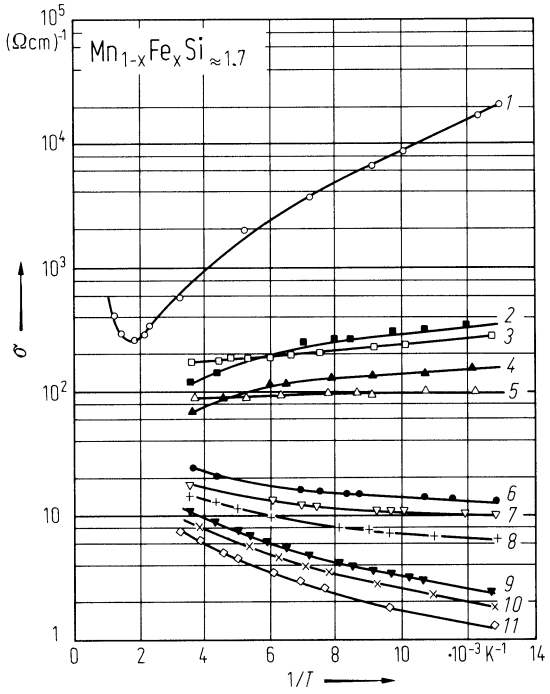

Fig. 3.

$Mn_{1-x}Fe_xSi_{\approx 1.72}$. Electrical conductivity vs. reciprocal temperature for oriented single crystals [74A].

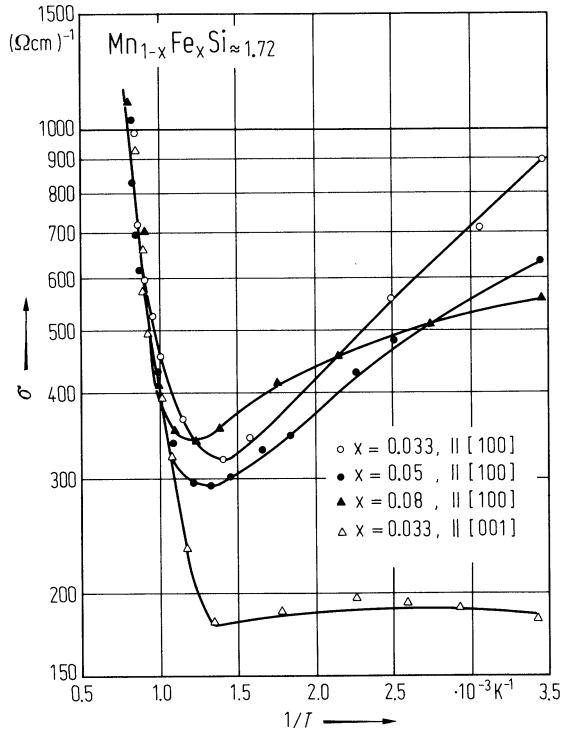

Fig. 4.

$Mn_{1-x}Fe_xSi_{\approx 1.72}$. Seebeck coefficient vs. reciprocal temperature for oriented single crystals [74A].

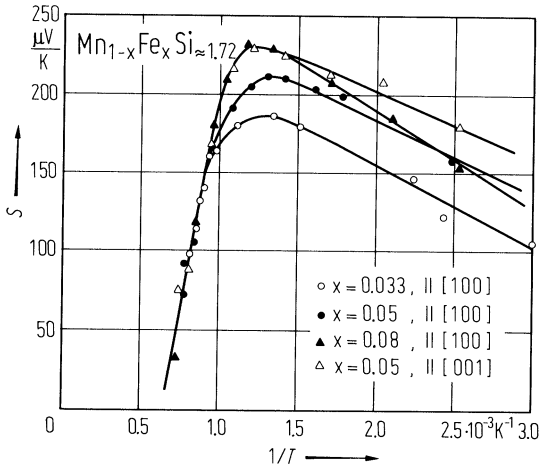

Fig. 5.

$Mn_{1-x}Fe_xSi_{\approx 1.7}$. Concentrations of electrons (a) and holes (h) vs. concentration x, as derived from the data of Fig. 1 [71N].