MgB_2, substituted MgB_2, and other diborides

MgB_2 crystals **$Mg^{11}B_2$** crystals **$MgB_{2-x}C_x$** crystals **$Mg_{1-x}Al_xB_2$** crystals

$Mg_{1-x}Mn_xB_2$ crystals **$Mg_{1-x}Li_xB_2$** crystals **$Mg_{1-x}Li_x(B_{1-y}C_y)_2$** crystals

$Mg_{1-x}(Al,Li)_xB_2$ crystals **$Mg_{1-x}Fe_xB_2$** crystals **$Mg_{1-x}Co_xB_2$** crystals

$Mg_{1-x}Cr_xB_2$ crystals **$Mg_{1-x}Pd_xB_2$** crystals **$Mg_{1-x}Zn_xB_2$** crystals

$Mg_{1-x}Sc_xB_2$ crystalline samples **TiB_2** powder **MoB_2** powder

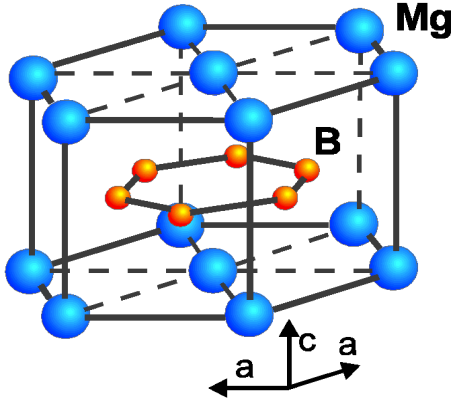
TaB_2 powder **CrB_2** powder

The prices on the products are available upon request and depend on various factors such as cost of the production, quality, dimensions, etc.

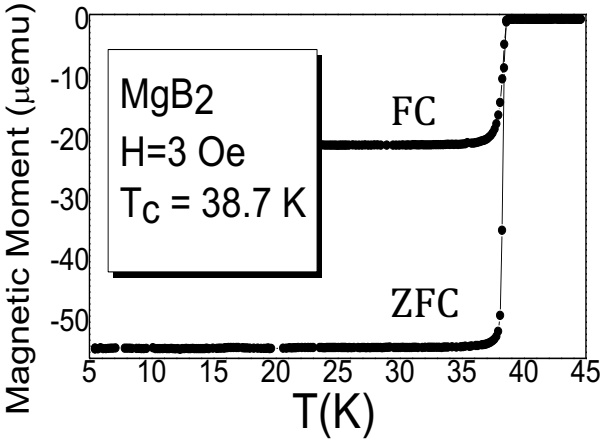
CRYST✚MAT request: nzhigadlo@gmail.com

MgB_2

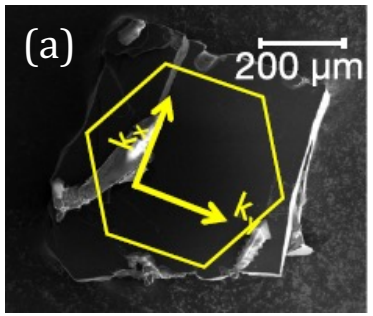
MgB_2 crystals, $T_C \approx 38.7$ K, sizes up to $1 \times 1 \times 0.1$ mm^3

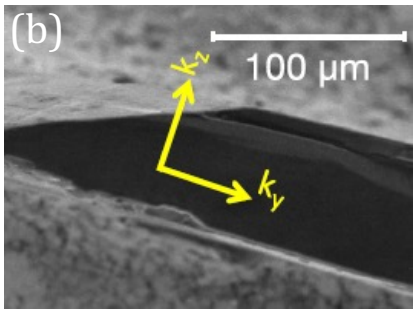


MgB_2 crystallizes in the hexagonal structure with P6/*mmm* space group



Magnetization ZFC and FC curves of MgB_2 crystal





In-plane (a) and edge-cleaved (b) views

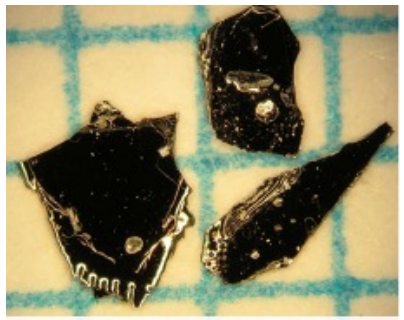


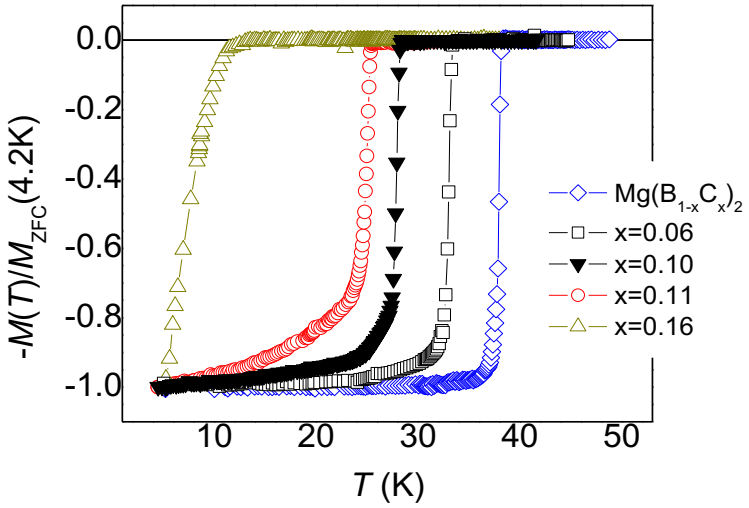
Image of MgB_2 crystals

MgB_2 is a two electronic bands, two energy gaps superconductor with a high T_c of 39 K and unusual properties such as temperature and field dependent anisotropy.

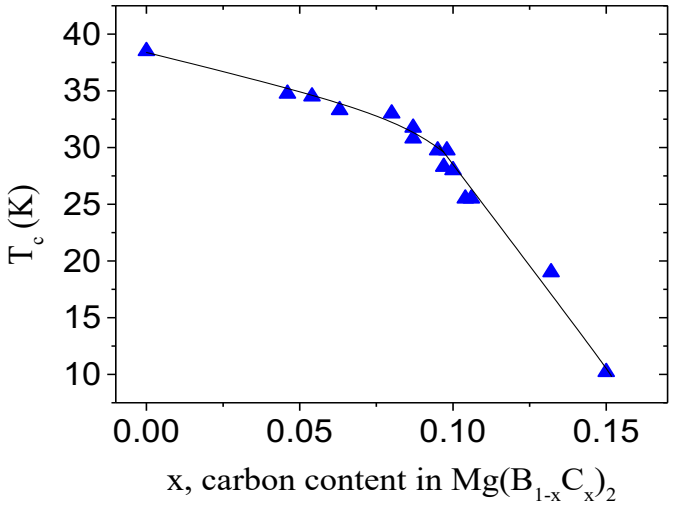
Ref.: Physica C 456 (2007) 3-13 Phys. Rev. B 100, 184511 (2019)

$MgB_{2-x}C_x$

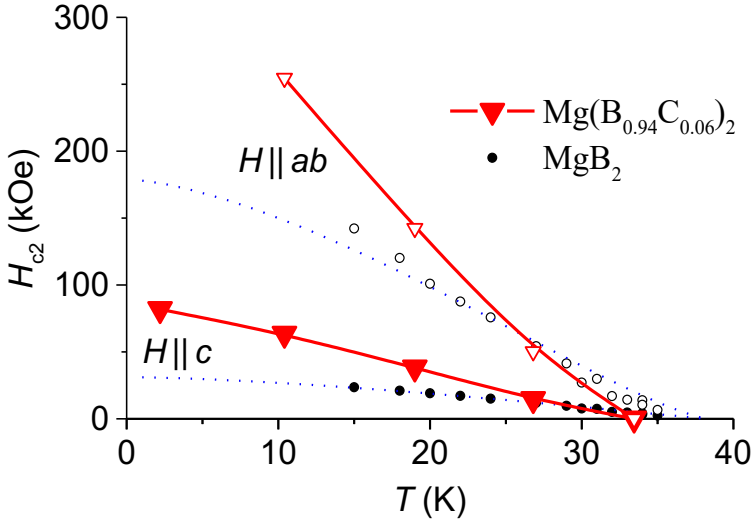
$MgB_{2-x}C_x$ crystals, T_c = 9 - 38.7 K, sizes up to 1 × 1 × 0.1 mm^3



Magnetization curves of $Mg(B_{1-x}C_x)_2$ crystals



Variation of T_c as a function of C content



Comparison of the upper critical fields

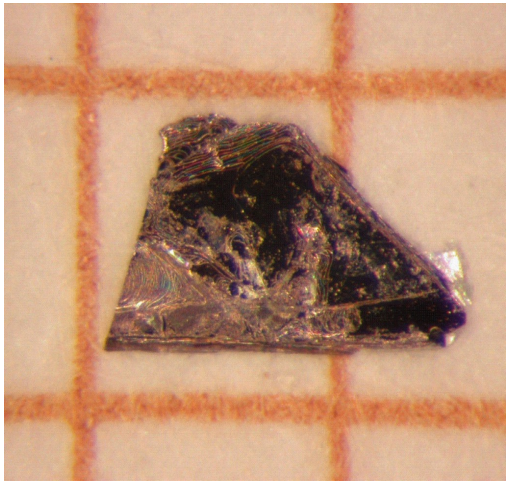
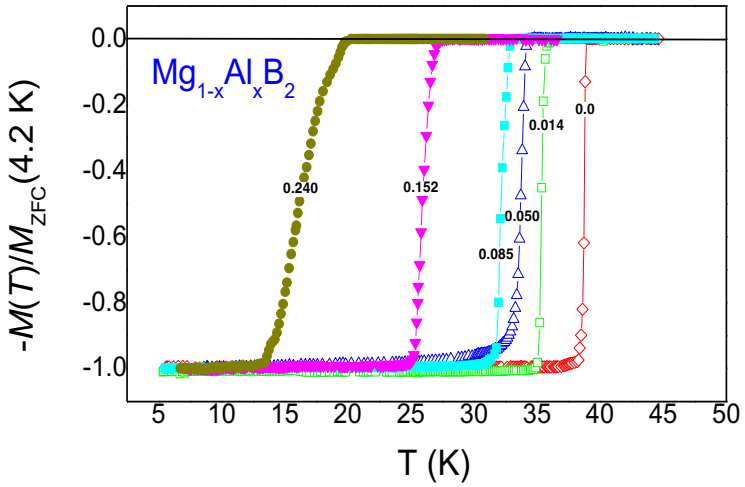


Image of C doped crystal. Scale is 1 mm

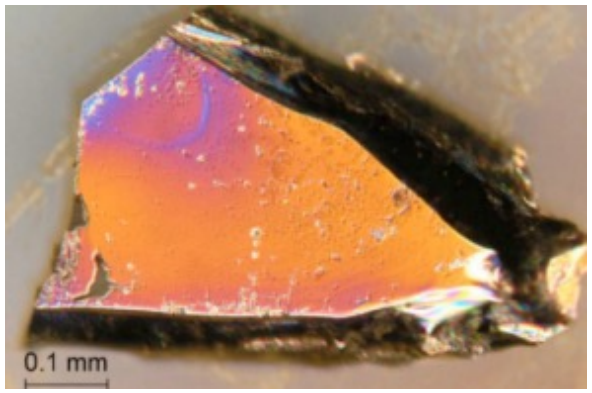
Ref.: Phys. Rev. B 71, 024533 (2005)

$Mg_{1-x}Al_xB_2$

$Mg_{1-x}Al_xB_2$ crystals, T_c = 20 - 38.7 K, sizes up to $1 \times 1 \times 0.2$ mm^3



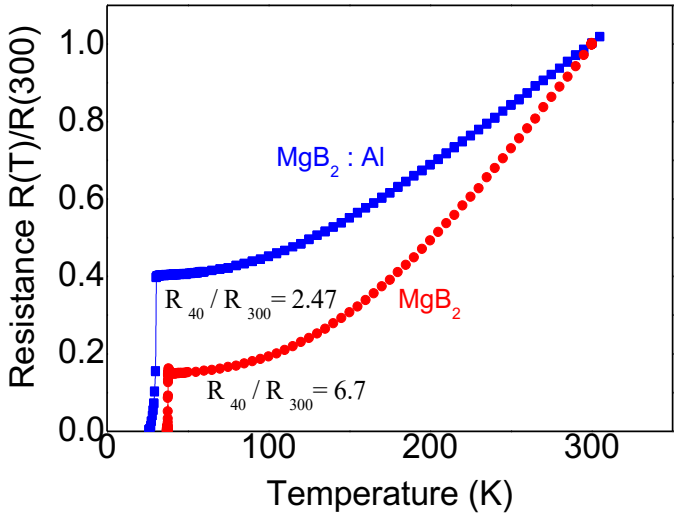
Magnetization curves of $Mg_{1-x}Al_xB_2$ crystals



Optical image of Al doped crystal

Substitution of Al for Mg introduces defects and for Al > 11% phase separation in the structure

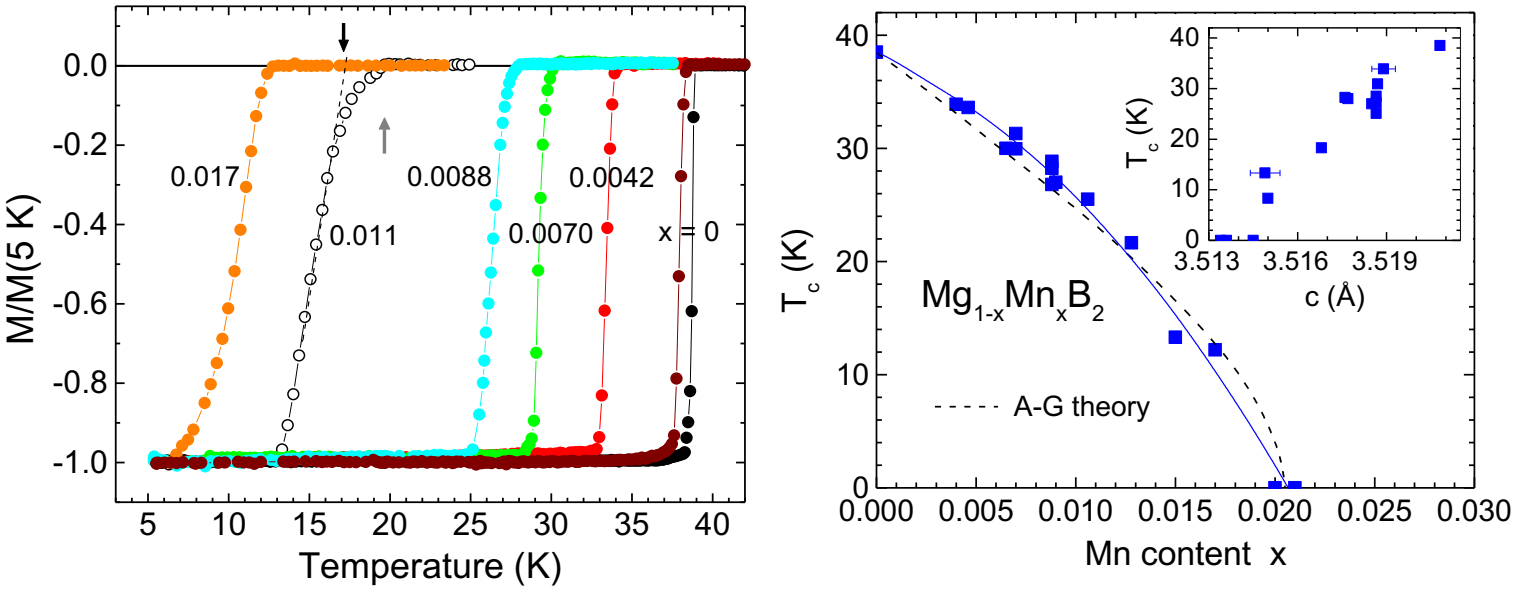
Ref.: Phys. Rev. B 71, 174506 (2005)



Al doping increases residual resistance by factor 3

$Mg_{1-x}Mn_xB_2$

$Mg_{1-x}Mn_xB_2$ crystals, sizes up to $1.0 \times 1.0 \times 0.1$ mm^3

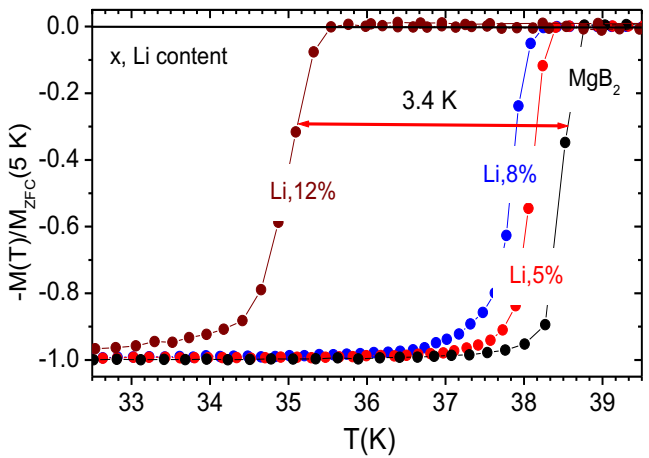


Normalized magnetic moment M vs temperature for the $Mg_{1-x}Mn_xB_2$ sigle crystals with various Mn content *x*. 2 % of Mn suppress T_c to 0 K. The dashed line shows $T_c(x)$ predicted by the A-G pair-breaking theory. Mn^{2+} in the low-spin (S = 1/2) configuration.

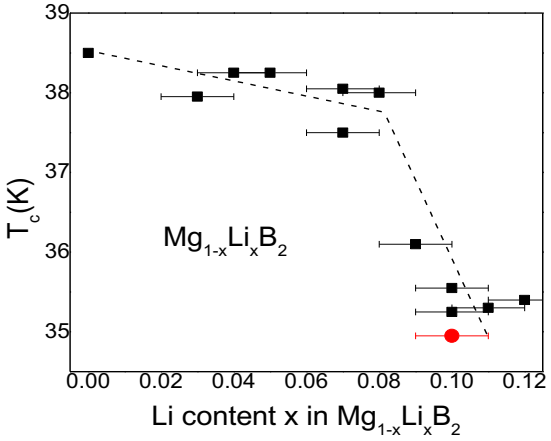
Ref.: Phys. Rev. B 73, 174520 (2006); Phys. Rev. Lett. 97, 037001 (2006)

$Mg_{1-x}Li_xB_2$

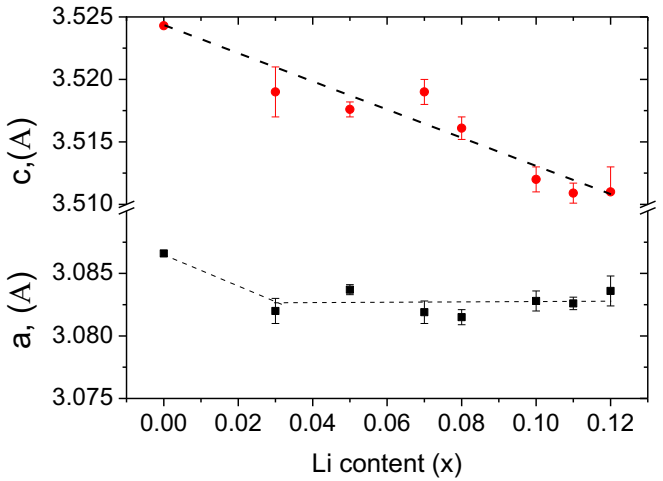
$Mg_{1-x}Li_xB_2$ crystals, T_c = 35 - 38.7 K, sizes up to 1.0 × 1.0 × 0.1 mm^3



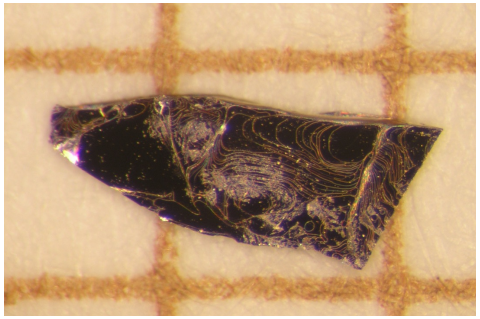
Magnetization curves of $Mg_{1-x}Li_xB_2$ crystals



T_c as a function of Li content



Lattice parameters *a* and *c* vs Li content



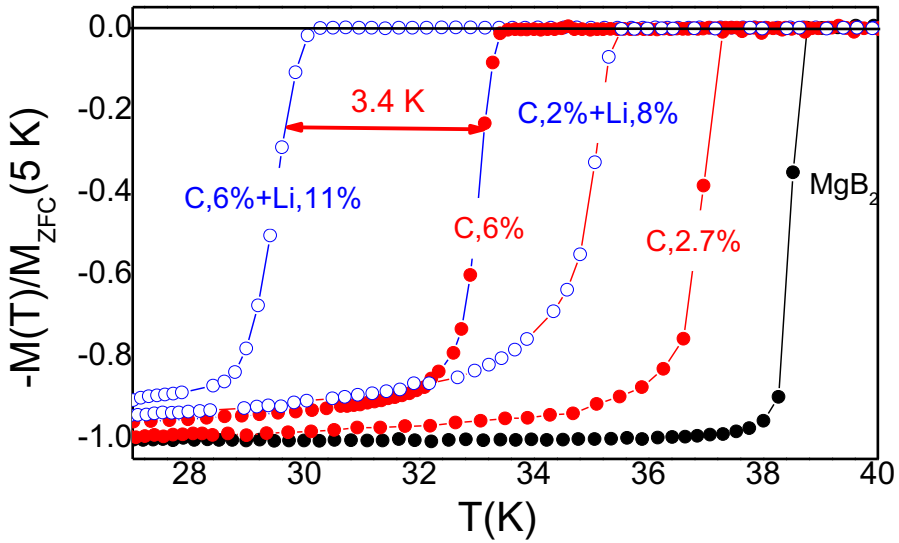
$Mg_{1-x}Li_xB_2$ crystal. Scale is 1 mm

Rapid changes of T_c above 8% Li may indicate changes in the defect or electronic structure. Lattice parameter *c* decreases much faster than *a*, similar to Al substitution.

Ref.: Phys. Rev. B 77, 214507 (2008)

$Mg_{1-x}Li_x(B_{1-y}C_y)_2$

$Mg_{1-x}Li_x(B_{1-y}C_y)_2$ crystals, T_c = 30 - 38.7 K, sizes up to $1 \times 1 \times 0.1$ mm^3



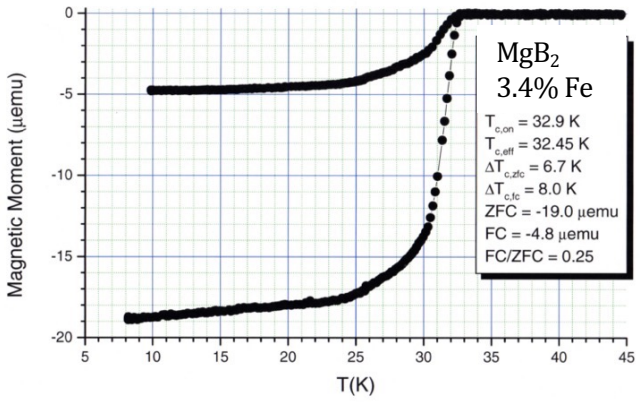
Normalized magnetic moment M vs temperature for crystals MgB_2 substituted with C and co-substituted with C and Li.

Li dopes MgB_2 with holes therefore one can expect compensation of electron doping with C and increase of T_c. But Li decreases T_c of C substituted crystals similar like in pure MgB_2. According to theory holes introduced by Li occupy π band and do not fill σ band. C substitution for B fills σ band.

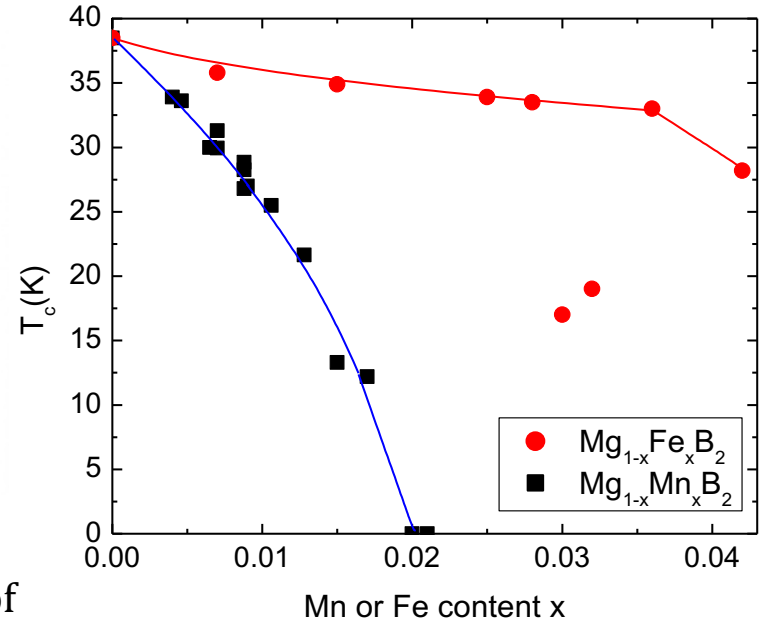
Ref.: Phys. Rev. B 77, 214507 (2008)

$Mg_{1-x}Fe_xB_2$

$Mg_{1-x}Fe_xB_2$ crystals, sizes up to $1 \times 1 \times 0.1$ mm^3, grown under high pressure



Magnetization ZFC and FC curves of $Mg(Fe)B_2$ crystal

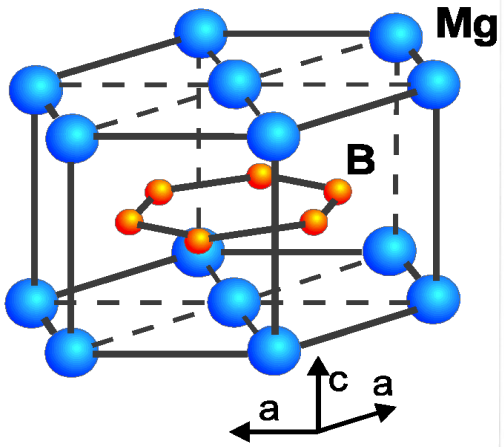


T_c as a function of Mn and Fe content

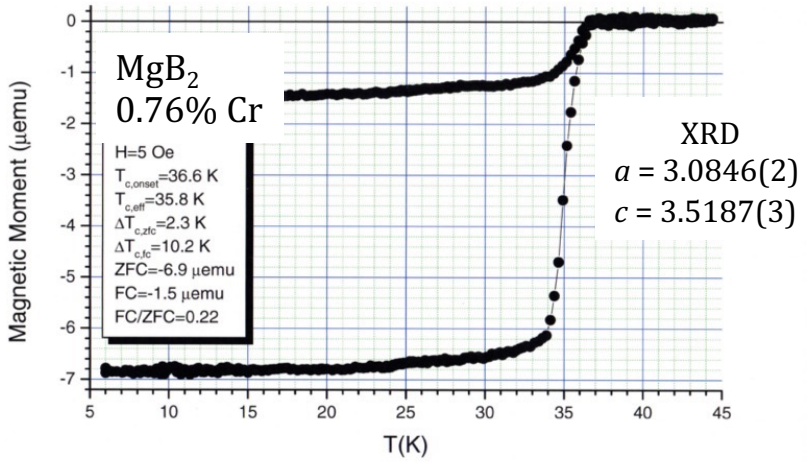
$T_c(x)$ for small Fe content up to x=0.03 is similar like for Al substitution. Suggestion: Fe is in non-magnetic state. For x > 0.03 some crystals show rapid decrease of T_c. Possibly Fe is in a magnetic state.

$Mg_{1-x}Cr_xB_2$

$Mg_{1-x}Cr_xB_2$ crystals, T_c = 35.0 - 38.7 K, sizes up to 1.0 × 1.0 × 0.1 mm^3



MgB_2 crystallizes in the hexagonal structure with P6/*mmm* space group



Magnetization ZFC and FC curves of $Mg(Cr)B_2$ crystal

$Mg^{11}B_2$

$Mg^{11}B_2$ crystals, T_c = 37 K, sizes up to 1.0 × 1.0 × 0.1 mm^3

Other substitutions

$Mg_{1-x}(Al,Li)_xB_2$ crystals, T_c = 27.0 - 38.7 K, sizes up to 1.0 × 1.0 × 0.1 mm^3

$Mg_{1-x}Co_xB_2$ crystals, T_c = 35.0 - 38.7 K, sizes up to 1.0 × 1.0 × 0.1 mm^3

$Mg_{1-x}Cr_xB_2$ crystals, T_c = 35.0 - 38.7 K, sizes up to 1.0 × 1.0 × 0.1 mm^3

$Mg_{1-x}Pd_xB_2$ crystals, T_c = 38.1 - 38.7 K, sizes up to 1.0 × 1.0 × 0.1 mm^3

$Mg_{1-x}Zn_xB_2$ crystals, T_c = 30.0 - 38.7 K, sizes up to 1.0 × 1.0 × 0.1 mm^3

$Mg_{1-x}Sc_xB_2$ crystalline samples, T_c = 26 K - 38 K

Polycrystalline diborides

TiB_2 titanium boride powder, 99.5%, 50 g

MoB_2 molybdenium boride powder, 99.8%, 50 g

TaB_2 tantalum boride powder, 5 g

CrB_2 chromium boride powder, 99.5%, 50 g