**Supplementary Information:**

**A Progress Report on the MAB Phases:**

**Atomically Laminated, Ternary Transition Metal Borides**

Sankalp Kota, Maxim Sokol and Michel W. Barsoum\*

*Department of Materials Science & Engineering, Drexel University, Philadelphia, PA, USA*

\* Corresponding author: Michel W. Barsoum ([barsoumw@drexel.edu](mailto:barsoumw@drexel.edu))

**Table S1**. Unit cell parameters, LPs, and volumes, V, reported in the literature. The standard uncertainties of the last digits for experimentally derived LPs are specified in parentheses.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Phase** | **a (Å)** | **b (****Å)** | **c (Å)** | **V (Å3)** | **Synthesis** | **Refs.** |
| **Cr2AlB2** | 2.937 | 11.07 | 2.971 | 96.59 | Arc-melted | (1) |
| 2.9373(3) | 11.0513(12) | 2.9675(3) | 96.3280 | Al flux | (2) |
| 2.9387(3) | 11.0605(1) | 2.9714(3) | 96.58 | Arc-melted | (3) |
| 2.9367(1) | 11.0471(3) | 2.9668(1) | 96.2490 | Furnace Synthesis | (4) |
| 2.9370(1) | 11.0465(4) | 2.9683(3) | 96.3023 | Furnace Synthesis | (5) |
| 2.949(6) | 11.10(1) | 2.948(5) | 96.53 | Arc-melted | (6) |
| 2.9392(5) | 11.0551(1) | 2.9701(6) | 96.512 | Furnace Synthesis | (7) |
| 2.9232 | 11.0511 | 2.9334 | 94.76 | DFT | (3) |
| 2.9407 | 11.0308 | 2.9642 | 96.1535 | DFT | (8) |
| 2.9256 | 11.0423 | 2.9366 | 94.87 | DFT | (9) |
| 2.921 | 11.034 | 2.929 | 94.403 | DFT | (10) |
| **Cr3AlB4** | 2.952 | 2.989 | 8.091 | 71.3912 | Arc-melted | (1) |
| 2.9489(1) | 2.985(4) | 8.077(4) | 71.110 | Furnace Synthesis | (4) |
| 2.9556(4) | 2.9778(5) | 8.0539(14) | 70.8839 | Al flux | (2) |
| 2.9533 | 2.9718 | 8.1043 | 71.1283 | DFT | (8) |
| 2.9380 | 2.9778 | 8.0538 | 69.95 | DFT | (9) |
| **Cr4AlB6** | 2.9517(4) | 21.280(3) | 3.0130(3) | 189.253 | Al flux | (2) |
| 2.9715 | 21.3894 | 2.9610 | 188.1970 | DFT | (8) |
| 2.9467 | 21.3217 | 3.0130 | 189.25 | DFT | (9) |
| **Mn2AlB2** | 2.92 | 11.08 | 2.89 | 93.50 | HPed | (11) |
| 2.9180(4) | 11.038(2) | 2.8932(5) | 93.1867 | Al flux | (2) |
| 2.936(5) | 11.12(1) | 2.912(8) | 95.06 | Arc-melted | (6) |
| 2.9231(2) | 11.0698(9) | 2.8993(2) | 92.82 | Arc-melted | (3) |
| 2.9166(6) | 11.048(3) | 2.8930(6) | 93.22 | Furnace Synthesis | (12) |
| 2.9300(6) | 11.0186(12) | 2.8975(8) | 93.54(3) | Arc-melted | (13) |
| 2.919(1) | 11.060(3) | 2.901(1) | 93.656 | Hot-pressed | (14) |
| 2.8949 | 11.0750 | 2.8306 | 90.7519 | DFT | (3) |
| 2.887 2.890 2.892 | 11.109 11.050 11.056 | 2.830 2.817 2.826 | 90.763 89.95949 90.358 | DFT (AFM) DFT (NM)  DFT (FM) | (10)\* |
| **Fe2AlB2** | 2.9233(10) | 11.0337(14) | 2.8703(3) | 92.58(5) | Induction melting | (15) |
| 2.923(2) | 11.046(5) | 2.875(2) |  |  | (16) |
| 2.9241(17) | 11.0339(3) | 2.8701(5) |  | Arc-melted | (17) |
| 2.9283(3) 2.9311(2) | 11.0334(4) 11.0376(3) | 2.8682(3) 2.8783(2) | 92.669 93.119 | Arc-melted Ga flux | (18) |
| 2.9054 | 10.9542 | 2.8271 |  | DFT | (19) |
| 2.9263(3) | 11.0295(9) | 2.8666(3) | 92.52(2) | Arc-melted | (13) |
| 2.945(4) | 11.09(1) | 2.887(3) | 94.39 | Arc-melted | (6) |
| 2.9308(2) | 11.0477(8) | 2.8755(2) | 93.103 | Melt spun | (20) |
| 2.9217(4) | 10.991(15) | 2.8563(5) | 91.79 | Al flux | (2) |
| 2.9256(4) 2.917 2.917 | 11.0247(4) 11.011 11.010 | 2.8709(2) 2.864 2.864 | 92.60 92.001 91.972 | Arc-melted DFT (PM) DFT (FM) | (21) |
| 2.931(1) | 11.028(4) | 2.861(1) | 92.5 | Arc-melted | (22) |
| 2.9258(4) | 11.0278(9) | 2.8658(3) |  | Arc-melted | (23) |
| 2.9290(7)  2.9315(4) 2.9251(3) | 11.0393(24) 11.0449(19) 11.0296(15) | 2.8671(7) 2.8733(6) 2.8685(3) | 92.707(24) 93.034(20) 92.546(25) | SPS Al flux  Arc-melted | (24) |
| 2.915 | 11.017 | 2.851 |  | DFT (FM) | (10) |
| 2.9286(3) | 11.032(1) | 2.8696(3) |  | Furnace Synthesis | (5) |
| 2.92398(04) 2.92195(04) | 11.02152(10) 11.01580(10) | 2.86464(04) 2.86335(04) |  | Arc-melted Arc-melted | (25) |
| 2.9258(4) | 11.0278(9) | 2.8658(3) | 92.46 | Arc-melted | (3) |
| 2.9162 | 11.0225 | 2.8515 | 91.66 | DFT | (3) |
| 2.929(0) | 11.034(9) | 2.866(2) |  | Arc-melted | (26) |
| 2.924(1) | 11.029(9) | 2.866(0) |  | Suction Cast | (27) |
| 2.9168(6) | 11.033(2) | 2.866(6) | 92.23 | Al flux | (28) |
| 2.929 | 11.035 | 2.870 | 92.763 | Arc-melted | (29) |
| **MoAlB** | 3.212(2) | 13.985(4) | 3.102(1) | 139.341 | Single Crystal | (30) |
| 3.206 | 14.01 | 3.050 | 136.994 | Single Crystal | (31) |
| 3.213(1) | 13.986(1) | 3.103(1) | 139.440 | Single Crystal | (32) |
| 3.1987(4) | 13.9218(14) | 3.0937(3) | 137.768 | Single Crystal | (2) |
| 3.21288(10) | 13.97818(43) | 3.10322(10) | 139.36628 | HPed | (33) |
| 3.1718 3.2227 | 13.825 14.037 | 3.0650 3.1067 |  | DFT (LDA) DFT (GGA) | (34) |
| 3.1960 | 13.9116 | 3.0912 |  | DFT (GGA) | (35) |
| 3.215 | 14.049 | 3.106 | 140.28 | DFT (GGA) | (36) |
| 3.2162 | 14.062 | 3.1030 |  | DFT (GGA) | (37) |
| 3.1898 | 13.9024 | 3.0982 |  | DFT (GGA) | (38) |
| **WAlB** | 3.205(1) | 13.947(1) | 3.108(1) | 138.928 | Single Crystal | (39) |
| 3.2016(3) | 13.9059(12) | 3.1020(2) | 138.1045 | Single Crystal | (2) |
| 3.2277 | 13.9945 | 3.1251 | 141.1609 | DFT (GGA) | (40) |
| 3.2219 | 14.008 | 3.1135 | 140.5197 | DFT (GGA) | (37) |
| 3.2125 | 13.947 | 3.1025 | 139.007 | DFT | (41) |

\*Three entries correspond to LPs calculated from assuming anti-ferromagnetic (AFM), non-magnetic (NM), and ferromagnetic (FM) configurations.

**Table S2**. Summary of Tpeak and SM values for oH = 2 T used to generate the convex hull plot in Figure 7 of the manuscript. Data for compounds with Tpeak 250 K to 350 K and *not* listed as having a first-order magnetic transition (i.e. FOMT) were obtained from the Supporting Information of Ref. (42). The references under columns with asterisk, contain reference numbers unchanged from Ref. (42).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Compound/Composition** | **Order** | | **T (K)** | **|SM|**  **(J K-1 kg-1)** | | **Refs** |
| ***Fe2AlB2-based*** | | | | | | |
| Fe2AlB2 (Sample 1a)  Fe2AlB2 (Sample 1b) | SOPT | | 282 | 4.4 | | (18) |
| 307 | 4.1 | |
| Fe2AlB2 | SOPT | | 303 | 3.4 | | (20) |
| (Fe0.95Mn0.05)2AlB2 | SOPT | | 288 | 2.53 | |
| Fe2AlB2 | SOPT | | 272 | 2.7 | | (43) |
| Fe2AlB2 | SOPT | | 285 | 2.4 | | (26) |
| SOPT | | 285 | 3.6 | |
| Fe2AlB2 | SOPT | | 274 | 3.78 | | (28) |
| Fe2AlB2 | SOPT | | 294 | 3.07 | | (29) |
| Fe2AlB2 (Ga=0.05) | SOPT | | 282 | 3.67 | | (43) |
| Fe2AlB2 (Ga=0.1) | SOPT | | 290 | 4.42 | | (43) |
| Fe2AlB2 (Ge=0.1) | SOPT | | 291 | 5.18 | | (43) |
| Fe2AlB2 (Ga=0.05, Ge=0.05) | SOPT | | 294 | 6.51 | | (43) |
| **Amorphous Alloys** | | | | | | |
| **Compound/Composition** | **Order** | | **T (K)** | **|SM|**  **(J K-1 kg-1)** | | **Refs\*** |
| Gd55.6Si22.2Ge22.2 |  | | 267 | 0.45 | | [490] |
| Fe88Zr8B4 |  | | 280 | 1.3 | | [541] |
| Fe87Zr6B6Cu1 |  | | 300 | 1.6 | | [541] |
| Fe86Zr7B6Cu1 |  | | 320 | 1.6 | | [541] |
| Fe70Cr8Cu1Nb5Si4B12 |  | | 285 | 1 | | [544] |
| Fe90Zr7B3 |  | | 257 | 1.05 | | [551] |
| Fe88Zr8B4 |  | | 280 | 1.3 | | [558] |
| Fe87Zr6B6Cu1 |  | | 300 | 1.6 | | [558] |
| Fe86Zr7B6Cu1 |  | | 320 | 1.6 | | [558] |
| Fe80B12Nb8 |  | | 329 | 1.7 | | [561] |
| Fe79B12Nb9 |  | | 306 | 1.3 | | [561] |
| Fe78B12Nb10 |  | | 278 | 1.25 | | [561] |
| Fe61B17Y22 |  | | 295 | 1.4 | | [561] |
| Fe77Ta3B10Zr9Cu1 |  | | 336 | 1.47 | | [563] |
| Fe75Ta5B10Zr9Cu1 |  | | 313 | 1.04 | | [563] |
| Fe60Ru20B20 |  | | 254 | 0.79 | | [570] |
| Fe83Nd5Cr8B4 |  | | 322 | 1.8 | | [572] |
| Fe80Nd8Cr8B4 |  | | 340 | 1.8 | | [572] |
| Fe78Nd10Cr8B4 |  | | 345 | 1.9 | | [572] |
| Fe76Nd12Cr8B4 |  | | 350 | 1.9 | | [572] |
| Fe73Nd15Cr8B4 |  | | 350 | 1.8 | | [572] |
| **Gd, Gd(Si,Ge)4** | | | | | | |
| **Compound/Composition** | **Order** | | **T (K)** | **|SM|**  **(J K-1 kg-1)** | | **Refs\*** |
| Gd | SOPT | | 295 | 6.1 | | (44) |
| Gd5Si2Ge1.98Ga0.02 | SOPT | | 298 | 4 | | [89] |
| Gd5Si2Ge1.96Ga0.04 | SOPT | | 298 | 4 | | [89] |
| Gd5Si2Ge1.94Ga0.06 | SOPT | | 298 | 3.5 | | [89] |
| Gd4.95Zr0.05Si2Ge2 | SOPT | | 295 | 5.5 | | [105] |
| Gd4.9Zr0.1Si2Ge2 | SOPT | | 283 | 3.4 | | [105] |
| Gd4.85Zr0.15Si2Ge2 | SOPT | | 281 | 3.5 | | [105] |
| Gd4.8Zr0.2Si2Ge2 | SOPT | | 272 | 3.2 | | [105] |
| **Heusler Alloys** | | | | | | |
| **Compound/Composition** | **Order** | | **T (K)** | **|SM|**  **(J K-1 kg-1)** | | **Refs\*** |
| Ni2Mn0.85Cu0.15Ga | SOPT | | 333 | 1.79 | | [313] |
| Ni54Mn21Ga25 | SOPT | | 315 | 2.49 | | [321] |
| Ni50.3Mn35.3Sn14.4 | SOPT | | 320 | 1.1 | | [326] |
| Ni45Mn44Sn11 | SOPT | | 285 | 1.7 | | [335] |
| Ni45Mn39Fe5Sn11 | SOPT | | 298 | 1 | | [335] |
| Ni45Mn34Fe8Sn11 | SOPT | | 312 | 1.2 | | [335] |
| **La(Fe,Si)13-based Compounds** | | | | | | |
| **Compound/Composition** | **Order** | **T (K)** | | **|SM|**  **(J K-1 kg-1)** | **Refs\*** | |
| La(Fe0.88Si0.12)13H1.0 |  | 274 | | 19 | [36] | |
| La(Fe0.89Si0.11)13H1.3 |  | 291 | | 24 | [36] | |
| La(Fe0.88Si0.12)13H1.5 |  | 323 | | 19 | [36] | |
| La(Fe0.9Si0.1)13H1.1 |  | 287 | | 28 | [36] | |
| La(Fe0.86Si0.09Co0.05)13 |  | 274 | | 12 | [37] | |
| LaFe11.2Co0.5Si1.3 |  | 253 | | 9.2 | [40] | |
| LaFe11.1Co0.6Si1.3 |  | 265 | | 8.7 | [40] | |
| LaFe11.2Co0.7Si1.1 |  | 270 | | 9.4 | [40] | |
| LaFe11.1Co0.8Si1.1 |  | 282 | | 8 | [40] | |
| LaFe11Co0.9Si1.1 |  | 294 | | 7.4 | [40] | |
| LaFe11.2Co0.7Si1.1C0.1 | SOPT | 290 | | 7.8 | [43] | |
| LaFe11.2Co0.7Si1.1C0.2 | SOPT | 304 | | 5.2 | [43] | |
| LaFe11.2Co0.7Si1.1C0.3 | SOPT | 310 | | 4.13 | [43] | |
| La0.7Nd0.3Fe10.7Co0.8Si1.5 |  | 280 | | 7.9 | [44] | |
| La(Fe0.88Si0.12)13H1.5 |  | 323 | | 19 | [45] | |
| La (Fe0.919Co0.081)11.7Al1.3 |  | 311 | | 3.6 | [45] | |
| La0.8Nd0.2(Fe0.919Co0.081)11.7Al1.3 |  | 294 | | 4.6 | [45] | |
| LaFe10.6Si2.4 |  | 250 | | 3 | [49] | |
| LaFe10.8Co0.7Si1.5C0.2 |  | 302 | | 4.9 | [52] | |
| La(Fe0.825Co0.07Si0.105)13 |  | 300 | | 5.3 | [54] | |
| La0.8Pr0.2(Fe0.825Co0.07Si0.105)13 |  | 294 | | 5.4 | [54] | |
| La0.6Pr0.4(Fe0.825Co0.07Si0.105)13 |  | 284 | | 6.9 | [54] | |
| La0.8Ce0.2Fe10.8Co0.7Si1.5 |  | 266 | | 6.8 | [59] | |
| LaFe11.1Co0.5Si1.5 |  | 250 | | 8.1 | [61] | |
| LaFe10.9Co0.7Si1.5 |  | 276 | | 5.23 | [61] | |
| LaFe10.85Co0.75Si1.5 |  | 281 | | 5.2 | [61] | |
| LaFe10.8Co0.8Si1.5 |  | 285 | | 4.57 | [61] | |
| La(Fe0.94Co0.06)11.9Si1.1 |  | 274 | | 12.2 | [35] | |
| La(Fe0.92Co0.08)11.9Si1.1 |  | 301 | | 8.7 | [35] | |
| LaFe10.7Co0.8Si1.5 |  | 285 | | 7 | [35] | |
| La0.8Pr0.2Fe10.7Co0.8Si1.5 |  | 280 | | 7.2 | [35] | |
| La0.6Pr0.4Fe10.7Co0.8Si1.5 |  | 274 | | 7.4 | [35] | |
| La0.5Pr0.5Fe10.7Co0.8Si1.5 | SOPT | 272 | | 8.1 | [35] | |
| La0.5Pr0.5Fe10.5Co1.0Si1.5 | SOPT | 295 | | 6 | [35] | |
| LaFe11.12Co0.71Al1.17 |  | 279 | | 4.6 | [35] | |
| **LaMnO3-based Compounds** | | | | | | |
| **Compound/Composition** | **Order** | | **T (K)** | **|SM|**  **(J K-1 kg-1)** | **Refs\*** | |
| La0.8Na0.2MnO3 | SOPT | | 335 | 2.83 | [147] | |
| La0.8Na0.15MnO3 | SOPT | | 320 | 2.98 | [147] | |
| La0.8Na0.1MnO3 | SOPT | | 295 | 2.97 | [147] | |
| La0.8Na0.05MnO3 | SOPT | | 260 | 3.48 | [147] | |
| La0.7Ca0.25Na0.05MnO3 |  | | 254 | 4.98 | [189] | |
| La0.8Na0.1Ca0.1MnO3 | SOPT | | 300 | 3.1 | [192] | |
| La0.8Na0.15Ca0.05MnO3 | SOPT | | 320 | 2.5 | [192] | |
| La0.8Na0.2MnO3 | SOPT | | 330 | 2.3 | [192] | |
| La0.7Ca0.25K0.05MnO3 |  | | 270 | 3.95 | [193] | |
| La0.7Ca0.225K0.075MnO3 |  | | 281 | 3.75 | [193] | |
| La0.7Ca0.20K0.10MnO3 |  | | 272 | 3.49 | [193] | |
| La0.7Ca0.2Ba0.1MnO3 | SOPT | | 300 | 3.1 | [200] | |
| La0.7Ca0.2Ba0.1MnO3 | SOPT | | 281 | 3.82 | [202] | |
| La0.7Ca0.2Ba0.1MnO3 | SOPT | | 284 | 3.51 | [202] | |
| La0.7Ca0.2Ba0.1MnO3 | SOPT | | 286 | 2.94 | [202] | |
| La0.7Ca0.2Ba0.1MnO3 | SOPT | | 270 | 2 | [202] | |
| La0.7Ca0.2Ba0.1MnO3 | SOPT | | 263 | 0.92 | [202] | |
| La0.8Cd0.15K0.05MnO3 | SOPT | | 260 | 2.6 | [209] | |
| La0.8Cd0.125K0.075MnO3 | SOPT | | 273 | 2.81 | [209] | |
| La0.8Cd0.1K0.1MnO3 | SOPT | | 282 | 3.25 | [209] | |
| La0.7Sr0.3Mn0.8Cr0.2O3 |  | | 286 | 1.203 | [223] | |
| La0.7Sr0.3Mn0.9Cr0.1O3 | SOPT | | 326 | 1.76 | [225] | |
| La0.67Ba0.33Mn0.95Sn0.05O3 | SOPT | | 340 | 1.9 | [226] | |
| La0.67Ba0.33Mn0.9Sn0.1O3 | SOPT | | 325 | 2.3 | [226] | |
| La0.67Ba0.33Mn0.85Sn0.15O3 | SOPT | | 288 | 2.5 | [226] | |
| La0.75Ca0.08Sr0.17MnO3 |  | | 336 | 2.87 | [235] | |
| La0.75Ca0.08Sr0.17Mn0.95Ga0.05 O3 |  | | 285 | 1.92 | [235] | |
| La0.75Ca0.08Sr0.17Mn0.925Fe0.075O3 |  | | 268 | 1.38 | [236] | |
| La0.7Ba0.15Sr0.15MnO3 | SOPT | | 316 | 1.27 | [238] | |
| La0.7Ba0.15Sr0.15Mn0.9Ga0.1O3 | SOPT | | 301 | 1.16 | [238] | |
| La0.7Ba0.15Sr0.15Mn0.8Ga0.2O3 | SOPT | | 300 | 1.02 | [238] | |
| La0.5Ce0.3Sr0.3MnO3 | SOPT | | 348 | 1.65 | [248] | |
| La0.4Ce0.3Sr0.3MnO3 | SOPT | | 310 | 1.15 | [248] | |
| La0.6Eu0.1Sr0.3MnO3 | SOPT | | 343 | 1.55 | [255] | |
| La0.5Eu0.2Sr0.3MnO3 | SOPT | | 281 | 0.93 | [255] | |
| La0.4Eu0.3Sr0.3MnO3 | SOPT | | 272 | 1.17 | [255] | |
| La0.47Gd0.2Sr0.33MnO3 | SOPT | | 299 | 1.59 | [258] | |
| La0.52Gd0.15Sr0.33MnO3 | SOPT | | 343 | 1.96 | [258] | |
| Pr0.55K0.05Sr0.4MnO3 | SOPT | | 303 | 2.26 | [263] | |
| Pr0.6Sr0.4MnO3 | SOPT | | 310 | 1.95 | [270] | |
| Pr0.6Sr0.35K0.05MnO3 | SOPT | | 301 | 3.09 | [270] | |
| Pr0.6Sr0.3K0.1MnO3 | SOPT | | 296 | 2.89 | [270] | |
| Pr0.6Sr0.25K0.15MnO3 | SOPT | | 287 | 3.05 | [270] | |
| Pr0.6Sr0.2K0.2MnO3 | SOPT | | 269 | 3.2 | [270] | |
| Pr0.63Sr0.37MnO3 |  | | 300 | 8.52 | [149] | |
| Pr0.5Sr0.5MnO3 | SOPT | | 280 | 1.26 | [274] | |
| Pr0.45Gd0.05Sr0.5MnO3 | SOPT | | 270 | 1.25 | [274] | |
| Pr0.4Gd0.1Sr0.5MnO3 | SOPT | | 250 | 1.02 | [274] | |
| La1.4Sr0.6Ca1.0Mn2O7 |  | | 320 | 0.84 | [292] | |
| La1.4Sr0.2Ca1.4Mn2O7 |  | | 268 | 1.2 | [292] | |
| La1.4Ca1.6Mn2O7 |  | | 270 | 11.3 | [292] | |

**Table S3**. Summary of Tpeak and SM values for oH = 5 T used to generate the convex hull plot in Figure 7 of the manuscript. Data for compounds with Tpeak 250 K to 350 K and *not* listed as having a first-order magnetic transition (i.e. FOMT) were obtained from the Supporting Information of Ref. (42). The references under columns with asterisk, contain reference numbers unchanged from Ref. (42).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Fe2AlB2-based*** | | | | | | |
| **Compound** | **Order** | | | **T (K)** | **|SM|**  **(J K-1 kg-1)** | **Refs** |
| Fe2AlB2 (Sample 1a)  Fe2AlB2 (Sample 1b) | SOPT | | | 282 | 7.3 | (18) |
| SOPT | | | 307 | 7.7 |
| Fe2AlB2 | SOPT | | | 274 | 6.4 | (24) |
| Fe2AlB2 | SOPT | | | 303 | 7.2 | (20) |
| (Fe0.95Mn0.05)2AlB2 | SOPT | | | 290 | 5.45 |
| ***Amorphous Alloys*** | | | | | | |
| **Compound** | **Order** | | | **T**  **(K)** | **|SM|**  **(J K-1 kg-1)** | **Refs\*** |
| Gd50Co45Fe5 |  | | | 289 | 3.8 | [469] |
| Gd80Al8.7Fe11.3 |  | | | 269 | 5 | [476] |
| Gd90Al4.3Fe5.7 |  | | | 280 | 7.2 | [476] |
| Gd55.6Si22.2Ge22.2 |  | | | 267 | 0.45 | [490] |
| Fe88Zr8B4 |  | | | 285 | 3.3 | [546] |
| Fe87Zr6B6Cu1 |  | | | 300 | 3.2 | [547] |
| Fe66.3B12Si8V13.7 |  | | | 334 | 1.8 | [569] |
| **Gd, Gd5(Si,Ge)4 Family** | | | | | | |
| **Compound** | **Order** | | | **T (K)** | **|SM|**  **(J K-1 kg-1)** | **Refs\*** |
| Gd | SOPT | | | 295 | 10.6 | (44) |
| Gd5Si4 | SOPT | | | 336 | 8.2 | [72] |
| Gd5Si3. 5Ge0.5 | SOPT | | | 331 | 7.3 | [72] |
| Gd5Si3Ge1 | SOPT | | | 323 | 8.7 | [72] |
| Gd5Si2. 5Ge1.5 | SOPT | | | 313 | 9.4 | [72] |
| Gd5Si2.06Ge1.94 | SOPT | | | 306 | 9.4 | [72] |
| Gd5Si1.95Ge2.05O0.05 | SOPT | | | 283 | 6.5 | [75] |
| Gd5Si1.95Ge2.05O0.05 |  | | | 300 | 7.4 | [75] |
| Gd5Si1.95Ge2.05O0.1 | SOPT | | | 283 | 7 | [75] |
| Gd5Si1.95Ge2.05O0.1 |  | | | 302 | 6.8 | [75] |
| Gd5Ge2.1Si1.9H0.09 | SOPT | | | 295 | 7.2 | [76] |
| Gd5Ge2.1Si1.9H 0.5 | SOPT | | | 290 | 6 | [76] |
| Gd5Ge2.1Si1.9H 1.2 | SOPT | | | 270 | 5.5 | [76] |
| Gd5Si2Ge1.9Fe0.1 | SOPT | | | 320 | 7 | [77] |
| Gd5Si1.985Ge1.985Fe0.03 | SOPT | | | 300 | 10 | [78] |
| Gd5Si1.985Ge1.985Co0.03 | SOPT | | | 300 | 9 | [78] |
| Gd5Si1.985Ge1.985Ni0.03 | SOPT | | | 295 | 13 | [78] |
| Gd5Si1.985Ge1.985Cu0.03 | SOPT | | | 295 | 11 | [78] |
| Gd5Si1.97Ge1.97Ga0.06 | SOPT | | | 295 | 9 | [78] |
| Gd5Si1.985Ge1.985Al0.03 | SOPT | | | 295 | 12 | [78] |
| Gd5Si2Ge1.9Cu0.1 |  | | | 300 | 7 | [79] |
| Gd5Si1.99Ge1.99Mn0.02 | SOPT | | | 295 | 6.5 | [82] |
| Gd5Si1.975Ge1.975Mn0.05 | SOPT | | | 295 | 6.5 | [82] |
| Gd5Si1.96Ge1.96Mn0.08 | SOPT | | | 295 | 6.3 | [82] |
| Gd5Si1.95Ge1.95Mn0.1 | SOPT | | | 295 | 6.1 | [82] |
| Gd5Si1.93Ge1.93Mn0.14 | SOPT | | | 295 | 5 | [82] |
| Gd5Si1.9Ge1.9Mn0.2 | SOPT | | | 295 | 5.4 | [82] |
| Gd5Si2Ge2C0.1 | SOPT | | | 295 | 7 | [78] |
| Gd5Si1.975Ge1.975Ga0.05 | SOPT | | | 298 | 6.5 | [88] |
| Gd5Si1.935Ge1.935Ga0.13 | SOPT | | | 298 | 6.1 | [88] |
| Gd5Si2Sb2 | SOPT | | | 254 | 3.7 | [100] |
| Gd5Si1.5Sb2.5 | SOPT | | | 271 | 4.2 | [100] |
| Gd5Si1Sb3 | SOPT | | | 295 | 4.6 | [100] |
| **Heusler Alloys** | | | | | | |
| **Compound** | **Order** | | | **T (K)** | **|SM|**  **(J K-1 kg-1)** | **Refs\*** |
| Ni50Mn36Sb8Ga6 | SOPT | | | 280 | 2.1 | [320] |
| Ni2Mn0.7Cu0.3Ga0.9Al0.1 | SOPT | | | 300 | 2.2 | [323] |
| Ni50Mn37Sn13 | SOPT | | | 310 | 3.4 | [325] |
| Ni40Mn50Sn10 | SOPT | | | 278 | 2.4 | [339] |
| Ni39Mn50Co1Sn10 | SOPT | | | 317 | 2.2 | [339] |
| Ni38Mn50Co2Sn10 | SOPT | | | 340 | 3.9 | [339] |
| Ni50Mn36Sn13Ge1 | SOPT | | | 314 | 2.4 | [356] |
| Ni50Mn36Sn13Ge2 | SOPT | | | 310 | 2.4 | [356] |
| Ni50Mn37Sn13 | SOPT | | | 300 | 5.7 | [358] |
| Ni49Pr1Mn37Sn13 | SOPT | | | 295 | 4.1 | [358] |
| Ni47Pr3Mn37Sn13 | SOPT | | | 305 | 1.8 | [358] |
| Ni50Mn35In15 | SOPT | | | 316 | 5.7 | [361] |
| Ni50Mn34.95In15.05 | SOPT | | | 328 | 6.6 | [361] |
| Ni50Mn34.8In15.2 | SOPT | | | 328 | 7 | [361] |
| Ni50Mn34In16 | SOPT | | | 325 | 6.8 | [361] |
| Ni47.74Mn37.06In15.20 | SOPT | | | 294 | 6.45 | [370] |
| Ni50Co1Mn34In15 | SOPT | | | 330 | 6 | [380, 381] |
| Ni44Cu2Mn43In11 | SOPT | | | 325 | 4 | [383] |
| Ni50Mn35In14Si1 | SOPT | | | 328 | 6.6 | [393] |
| Ni50Mn35In13Si2 | SOPT | | | 300 | 5.9 | [393] |
| Ni50Mn35In12Si3 | SOPT | | | 283 | 4.8 | [393] |
| Ni50Mn35In11Si4 | SOPT | | | 280 | 3.6 | [393] |
| Ni50Mn35In10Si5 | SOPT | | | 281 | 3.7 | [393] |
| Ni50Mn35In14Si1 | SOPT | | | 307 | 6.6 | [396] |
| Ni50Mn35In14Ge1 | SOPT | | | 310 | 6 | [396] |
| Ni50Mn35In14Al1 | SOPT | | | 320 | 4.7 | [396] |
| Ni50Mn34In16 | SOPT | | | 308 | 5 | [397] |
| Ni50Mn34In14Ga2 | SOPT | | | 293 | 5 | [397] |
| Ni48.4Co1.9Mn34.2In13.8Ga1.7 | SOPT | | | 335 | 5.7 | [399] |
| Ni50Mn35In14B1 | SOPT | | | 326 | 7 | [402] |
| Ni50Mn35In13.9B1.1 | SOPT | | | 320 | 6 | [402] |
| Ni50.51Mn34.34In14.14B1.01 | SOPT | | | 320 | 6.7 | [403] |
| Ni50.51Mn33.08Cu1.26In14.14B1.01 | SOPT | | | 318 | 7.27 | [403] |
| Ni50.51Mn34.34In12.12Cu2.02B1.01 | SOPT | | | 314 | 5.98 | [403] |
| Fe2MnSi0.5Ge0.5 | SOPT | | | 260 | 1.7 | [416] |
| Co50Cr25Al25 | SOPT | | | 328.5 | 2.55 | [424] |
| **La(Fe,Si)13-based Compositions** | | | | | | |
| **Compound** | **Order** | | | **T (K)** | **|SM|**  **(J K-1 kg-1)** | **Refs\*** |
| La(Fe0.88Si0.12)13H1.0 |  | | | 274 | 23 | [36] |
| La(Fe0.89Si0.11)13H1.3 |  | | | 291 | 28 | [36] |
| La(Fe0.88Si0.12)13H1.5 |  | | | 323 | 23 | [36] |
| La(Fe0.9Si0.1)13H1.1 |  | | | 287 | 31 | [36] |
| La(Fe0.86Si0.09Co0.05)13 |  | | | 274 | 20 | [37] |
| La(Fe0.96Co0.04)11.44Al1.56 |  | | | 250 | 5.49 | [39] |
| La(Fe0.92Co0.08)11.44Al1.56 |  | | | 320 | 4.65 | [39] |
| La(Fe0.88Co0.12)11.44Al1.56 |  | | | 370 | 4.75 | [39] |
| LaFe11.2Co0.5Si1.3 |  | | | 253 | 15.5 | [40] |
| LaFe11.1Co0.6Si1.3 |  | | | 265 | 15 | [40] |
| LaFe11.2Co0.7Si1.1 |  | | | 270 | 16.5 | [40] |
| LaFe11.1Co0.8Si1.1 |  | | | 282 | 15 | [40] |
| LaFe11Co0.9Si1.1 |  | | | 294 | 13.5 | [40] |
| LaFe11.2Co0.7Si1.1C0.1 | SOPT | | | 290 | 14.5 | [43] |
| LaFe11.2Co0.7Si1.1C0.2 | SOPT | | | 304 | 9.8 | [43] |
| LaFe11.2Co0.7Si1.1C0.3 | SOPT | | | 310 | 8.3 | [43] |
| La0.7Nd0.3Fe10.7Co0.8Si1.5 |  | | | 280 | 15 | [44] |
| LaFe10.6Si2.4 |  | | | 250 | 4.8 | [49] |
| La(Fe0.94Co0.06)11.9Si1.1 |  | | | 274 | 19.7 | [35] |
| La(Fe0.92Co0.08)11.9Si1.1 |  | | | 301 | 15.6 | [35] |
| LaFe10.7Co0.8Si1.5 |  | | | 285 | 13.5 | [35] |
| La0.8Pr0.2Fe10.7Co0.8Si1.5 |  | | | 280 | 13.6 | [35] |
| La0.6Pr0.4Fe10.7Co0.8Si1.5 |  | | | 274 | 14.2 | [35] |
| La0.5Pr0.5Fe10.7Co0.8Si1.5 | SOPT | | | 272 | 14.6 | [35] |
| La0.5Pr0.5Fe10.5Co1.0Si1.5 | SOPT | | | 295 | 11.7 | [35] |
| LaFe11.12Co0.71Al1.17 |  | | | 279 | 9.1 | [35] |
| La0.8Ce0.2Fe10.9Co0.8Si1.3 |  | | | 269 | 15 | [64] |
| La0.8Ce0.2Fe10.7Co1.0Si1.3 |  | | | 291 | 15 | [64] |
| La0.8Ce0.2Fe10.5Co1.2Si1.3 |  | | | 313 | 14 | [64] |
| La0.7(Ce,Pr,Nd)0.3Fe11.6Si1.4H1.6 |  | | | 379 | 25.4 | [66] |
| **LaMnO3-based Compounds** | | | | | | |
| **Compound** | | | **Order** | **T (K)** | **|SM|**  **(J K-1 kg-1)** | **Refs\*** |
| La0.7Sr0.3MnO3 | | | SOPT | 365 | 4.44 | [176] |
| La0.67Sr0.33MnO3 | | | SOPT | 370 | 5.15 | [177] |
| La0.67Ba0.33MnO3 | | |  | 292 | 1.48 | [149, 161] |
| La0.65Ca0.30Na0.05MnO3 | | | SOPT | 277 | 6.98 | [190] |
| La0.65Ca0.25Na0.10MnO3 | | | SOPT | 279 | 4.76 | [190] |
| La0.65Ca0.20Na0.15MnO3 | | | SOPT | 314 | 4.96 | [190] |
| La0.65Ca0.15Na0.20MnO3 | | | SOPT | 317 | 4.65 | [190] |
| La0.7Ca0.25Sr0.05MnO3 | | |  | 275 | 10.5 | [149, 197] |
| La0.7Ca0.2Sr0.1MnO3 | | |  | 308 | 7.45 | [149, 197] |
| La0.7Ca0.1Sr0.2MnO3 | | |  | 340 | 6.97 | [149, 197] |
| La0.7Ca0.05Sr0.25MnO3 | | |  | 341 | 6.86 | [149, 197] |
| La0.65Bi0.05Sr0.3MnO3 | | | SOPT | 353 | 5.02 | [176] |
| La0.6Bi0.1Sr0.3MnO3 | | | SOPT | 334 | 4.81 | [176] |
| La0.5Bi0.2Sr0.3MnO3 | | | SOPT | 296 | 4.21 | [176] |
| La0.67Ba0.18Zn0.15MnO3 | | | SOPT | 260 | 3.39 | [208] |
| La0.7Na0.05Sr0.25MnO3 | | | SOPT | 363 | 4.34 | [212] |
| La0.67Ca0.33Mn0.97V0.03O3 | | |  | 277.5 | 6.7 | [213] |
| La0.67Ca0.33Mn0.94V0.06O3 | | |  | 277.5 | 6.29 | [213] |
| La0.67Ca0.33Mn0.9V0.1O3 | | |  | 277.5 | 6.13 | [213] |
| La0.67Ca0.33Mn0.85V0.15O3 | | |  | 287.5 | 4.44 | [213] |
| La0.67Ca0.33Mn0.75V0.25O3 | | |  | 287.5 | 3.13 | [213] |
| La0.67Ca0.33Mn0.5V0.5O3 | | |  | 287.5 | 2.94 | [213] |
| La0.75Sr0.25Mn0.8Cr0.2O3 | | | SOPT | 278 | 3.9 | [216] |
| La0.75Sr0.25Mn0.75Cr0.25O3 | | | SOPT | 253 | 4.2 | [216] |
| La0.7Ca0.2Sr0.1MnO3 | | | SOPT | 294 | 6.2 | [217] |
| La0.7Ca0.2Sr0.1Mn0.95Co0.05O3 | | | SOPT | 280 | 4.6 | [217] |
| La0.7Ca0.2Sr0.1Mn0.9Co0.1O3 | | | SOPT | 255 | 3.8 | [217] |
| La0.8Ca0.1Ba0.1MnO3 | | | SOPT | 282 | 3.2 | [218] |
| La0.67Ba0.33Mn0.98Ti0.02O3 | | | SOPT | 314 | 3.24 | [227] |
| La0.67Ba0.33MnO3 | | |  | 332 | 3.51 | [228] |
| La0.67Ba0.33Mn0.95Fe0.05O3 | | |  | 271 | 2.54 | [228] |
| La0.67Sr0.22Ba0.11MnO3 | | | SOPT | 360 | 2.46 | [229] |
| La0.67Sr0.22Ba0.11Mn0.9Fe0.1O3 | | | SOPT | 268 | 2.43 | [229] |
| La0.67Ba0.22Sr0.11Mn0.9Ti0.1O3 | | | SOPT | 280 | 1.33 | [231] |
| La0.8Ba0.1Ca0.1Mn0.97Fe0.03O3 | | | SOPT | 281 | 4.28 | [237] |
| La0.6Pr0.1Sr0.3MnO3 | | | SOPT | 360 | 3.32 | [243] |
| La0.6Pr0.1Sr0.3Mn0.95Ru0.05O3 | | | SOPT | 350 | 3.11 | [243] |
| La0.6Pr0.1Sr0.3Mn0.85Ru0.15O3 | | | SOPT | 344 | 2.57 | [243] |
| La0.57Nd0.1Sr0.33Mn0.95Sn0.05 O3 | | |  | 282 | 2.8 | [245] |
| La0.67Pb0.33MnO3 | | | SOPT | 360 | 4.26 | [246] |
| La0.52Dy0.15Pb0.33MnO3 | | | SOPT | 290 | 3.51 | [246] |
| La0.47Dy0.2Pb0.33MnO3 | | | SOPT | 277 | 2.3 | [246] |
| La0.65Eu0.05Sr0.3Mn0.95Cr0.05 O3 | | | SOPT | 338 | 4.04 | [257] |
| La0.65Eu0.05Sr0.3Mn0.9Cr0.1O3 | | | SOPT | 310 | 3.35 | [257] |
| La0.65Eu0.05Sr0.3Mn0.85Cr0.15 O3 | | | SOPT | 278 | 2.65 | [257] |
| Pr0.5Y0.1Sr0.4MnO3 | | | SOPT | 310 | 3.54 | [261] |
| Pr0.5Eu0.1Sr0.4MnO3 | | | SOPT | 270 | 3.81 | [261] |
| Pr0.6Ca0.1Sr0.3MnO3 | | |  | 256 | 3.64 | [267] |
| Pr0.6Ca0.1Sr0.3Mn0.925Fe0.075O3 | | |  | 270 | 3.12 | [267] |
| Pr0.63Sr0.37MnO3 | | |  | 300 | 8.52 | [149] |
| Pr0.55Sr0.45MnO3 | | |  | 304 | 3.32 | [275] |
| **Laves Phases RE(TM)2** | | | | | | |
| **Compound** | | **Order** | | **T (K)** | **|SM|**  **(J K-1 kg-1)** | **Refs\*** |
| Gd(Co0.35Mn0.65)2 | | SOPT | | 300 | 3.4 | [4] |
| Gd(Co0.3Mn0.7)2 | | SOPT | | 270 | 3.8 | [4] |
| Tb(Co0.9Mn0.1)2 | | SOPT | | 308 | 3.2 | [17] |



**Figure S1**. Fitting Cp/Tvs. T2 for Fe2AlB2 powders, using cp vs. T data obtained from authors of Ref. (18)

# References

1. Chaban NF, Kuz’ma IUB. Ternary systems Cr-Al-B and Mn-Al-B. Neorg Mater. 1973;9:1908–11.

2. Ade M, Hillebrecht H. Ternary Borides Cr2AlB2, Cr3AlB4, and Cr4AlB6 : The First Members of the Series (CrB2)nCrAl with n = 1, 2, 3 and a Unifying Concept for Ternary Borides as MAB-Phases. Inorg Chem. 2015 Jul 6;54(13):6122–35.

3. Kádas K, Iuşan D, Hellsvik J, Cedervall J, Berastegui P, Sahlberg M, et al. AlM2B2 (M = Cr, Mn, Fe, Co, Ni): a group of nanolaminated materials. J Phys Condens Matter. 2017 Apr 20;29(15):155402.

4. Kota S, Wang W, Lu J, Natu V, Opagiste C, Ying G, et al. Magnetic properties of Cr2AlB2, Cr3AlB4, and CrB powders. J Alloys Compd. 2018 Oct;767:474–82.

5. Lu J, Kota S, Barsoum MW, Hultman L. Atomic structure and lattice defects in nanolaminated ternary transition metal borides. Mater Res Lett. 2017 Jul 4;5(4):235–41.

6. Chai P, Stoian S a., Tan X, Dube P a., Shatruk M. Investigation of magnetic properties and electronic structure of layered-structure borides AlT2B2 (T = Fe, Mn, Cr) and AlFe2–xMnxB2. J Solid State Chem. 2015 Apr;224:52–61.

7. Zhang H, Dai F-Z, Xiang H, Wang X, Zhang Z, Zhou Y. Phase pure and well crystalline Cr2AlB2: A key precursor for two-dimensional CrB. J Mater Sci Technol. 2019;

8. Zhou Y, Xiang H, Dai F-Z, Feng Z. Electrical conductive and damage-tolerant nanolaminated MAB phases Cr2AlB2, Cr3AlB4 and Cr4AlB6. Mater Res Lett. 2017;0(0):1–9.

9. Li X, Chagas da Silva M, Salahub DR. First-principles calculations of the structural, mechanical, electronic and bonding properties of (CrB2)nCrAl with n = 1, 2, 3. J Alloys Compd. 2017;698:357–63.

10. Ke L, Harmon BN, Kramer MJ. Electronic structure and magnetic properties in T2AlB2 (T=Fe,Mn, Cr, Co, and Ni) and their alloys. Phys Rev B. 2017 Mar 20;95(10):104427.

11. Becher HJ, Krogmann K, Peisker E. Über das ternäre Borid Mn2AlB2. Zeitschrift fur Anorg und Allg Chemie. 1966 May;344(3–4):140–7.

12. Potashnikov D, Caspi EN, Pesach A, Hoser A, Kota S, Verger L, et al. Magnetic ordering in the nano-laminar ternary Mn2AlB2 using neutron and X-ray diffraction. J Magn Magn Mater. 2018 Sep;

13. Cedervall J, Andersson MS, Iuşan D, Delczeg-czirjak EK, Jansson U, Nordblad P, et al. Magnetic and mechanical effects of Mn substitutions in AlFe2B2. J Magn Magn Mater. 2019;482(March):54–60.

14. Kota S, Chen Y, Wang J, May SJ, Radovic M, Barsoum MW. Synthesis and characterization of the atomic laminate Mn2AlB2. J Eur Ceram Soc. 2018 Dec;38(16):5333–40.

15. Jeitschko W. The crystal structure of Fe2AlB2. Acta Crystallogr Sect B Struct Crystallogr Cryst Chem. 1969;25(1):163–5.

16. Kuz’ma YB, Chaban NF. Crystal Structure of the Compound Fe2AlB2. from Izv Akad Nauk SSSR, Neorg Mater. 1969;5(2):384–5.

17. Lejeune BT, Du X, Barua R, Zhao J, Lewis LH. Anisotropic thermal conductivity of magnetocaloric AlFe2B2. Materialia. 2018 Sep;1:150–4.

18. Tan X, Chai P, Thompson CM, Shatruk M. Magnetocaloric Effect in AlFe2B2: Toward Magnetic Refrigerants from Earth-Abundant Elements. J Am Chem Soc. 2013 Jun 26;135(25):9553–7.

19. Cheng Y, Lv ZL, Chen XR, Cai LC. Structural, electronic and elastic properties of AlFe2B2: First-principles study. Comput Mater Sci. 2014 Sep;92:253–7.

20. Du Q, Chen G, Yang W, Song Z, Hua M, Du H, et al. Magnetic properties of AlFe2B2 and CeMn2Si2 synthesized by melt spinning of stoichiometric compositions. Jpn J Appl Phys. 2015 May 1;54(5):053003.

21. Cedervall J, Andersson MS, Sarkar T, Delczeg-Czirjak EK, Bergqvist L, Hansen TC, et al. Magnetic structure of the magnetocaloric compound AlFe2B2. J Alloys Compd. 2016;664:784–91.

22. Lewis LH, Barua R, Lejeune B. Developing magnetofunctionality: Coupled structural and magnetic phase transition in AlFe2B2. J Alloys Compd. 2015;650:482–8.

23. Cedervall J, Häggström L, Ericsson T, Sahlberg M. Mössbauer study of the magnetocaloric compound AlFe2B2. Hyperfine Interact. 2016;237(1):47.

24. Hirt S, Yuan F, Mozharivskyj Y, Hillebrecht H. AlFe2-xCoxB2 (x = 0-0.30): Tc Tuning through Co Substitution for a Promising Magnetocaloric Material Realized by Spark Plasma Sintering. Inorg Chem. 2016 Oct 3;55(19):9677–84.

25. Ali T, Khan MN, Ahmed E, Ali A. Phase analysis of AlFe2B2 by synchrotron X-ray diffraction, magnetic and Mössbauer studies. Prog Nat Sci Mater Int. 2017;(March):1–6.

26. Barua R, Lejeune BT, Ke L, Hadjipanayis G, Levin EM, McCallum RW, et al. Anisotropic magnetocaloric response in AlFe2B2. J Alloys Compd. 2018;745:505–12.

27. Levin EM, Jensen BA, Barua R, Lejeune B, Howard A, McCallum RW, et al. Effects of Al content and annealing on the phase formation, lattice parameters, and magnetization of AlxFe2B2 (x = 1.0, 1.1, 1.2) alloys. Phys Rev Mater. 2018;2(3):034403.

28. Lamichhane TN, Xiang L, Lin Q, Pandey T, Parker DS, Kim T-H, et al. Magnetic properties of single crystalline itinerant ferromagnet AlFe2B2. Phys Rev Mater. 2018 Aug 20;2(8):084408.

29. Lee JW, Song MS, Cho KK, Cho BK, Nam C. Magnetocaloric Properties of AlFe2B2 Including Paramagnetic Impurities of Al13Fe4. J Korean Phys Soc. 2018;73(10):1555–60.

30. Jeitschko W. Die Kristallstruktur von MoAlB. Monatshefte für Chemie und verwandte Teile anderer Wissenschaften. 1966;97(5):1472–6.

31. Sinel’nikova VS, Gurin VN, Pilyankevich AN, Strashinskaya LV, Korsukova MM. Technology and properties of single crystals of refractory borides. J Less Common Met. 1976 Jun;47:265–72.

32. Okada S, Iizumi K, Kudaka K, Kudou K, Miyamoto M, Yu Y, et al. Single Crystal Growth of (MoxCr1−x)AlB and (MoxW1−x)AlB by Metal Al Solutions and Properties of the Crystals. J Solid State Chem. 1997;133(1):36–43.

33. Kota S, Zapata-Solvas E, Ly A, Lu J, Elkassabany O, Huon A, et al. Synthesis and Characterization of an Alumina Forming Nanolaminated Boride: MoAlB. Sci Rep. 2016;6(April):26475.

34. Bai Y, Qi X, Duff A, Li N, Kong F, He X, et al. Density functional theory insights into ternary layered boride MoAlB. Acta Mater. 2017;132:69–81.

35. Rajpoot P, Rastogi A, Verma UP. Systematic investigation of structural, electronic, optical and thermal properties of ternary MoAlB; an ab initio approach. Mater Res Express. 2018 Feb 1;5(2):025701.

36. Ali MA, Hadi MA, Hossain MM, Naqib SH, Islam AKMA. Theoretical investigation of structural, elastic, and electronic properties of ternary boride MoAlB. Phys Status Solidi. 2017;3(March):1700010.

37. Dai FZ, Feng Z, Zhou Y. First-principles investigation on the chemical bonding, elastic properties and ideal strengths of MoAlB and WAlB nanolaminated MAB phases. Comput Mater Sci. 2018;147:331–7.

38. Li X, Cui H, Zhang R. First-principles study of the electronic and optical properties of a new metallic MoAlB. Sci Rep. 2016;6:39790.

39. Zhang Y, Okada S, Atoda T, Yamabe T, Yasumori I. Synthesis of new compound WAlB using aluminum flux. J Ceram Ind Assoc. 1987;95(1100):374–80.

40. Li X-H, Cui H-L, Yong Y-L, Zhang R-Z. Theoretical investigation of electronic, bonding and optical properties of nanolaminated boride WAlB. Mater Chem Phys. 2018 Jun;212:122–30.

41. Xiang H, Feng Z, Li Z, Zhou Y. Theoretical investigations on mechanical and dynamical properties of MAlB (M = Mo, W) nanolaminated borides at ground-states and elevated temperatures. J Alloys Compd. 2018 Mar;738(13):461–72.

42. Franco V, Blázquez JS, Ipus JJ, Law JY, Conde A. Progress in Materials Science Magnetocaloric effect : From materials research to refrigeration devices. Prog Mater Sci. 2018;93:112–232.

43. Barua R, Lejeune BT, Jensen BA, Ke L, McCallum RW, Kramer MJ, et al. Enhanced room-temperature magnetocaloric effect and tunable magnetic response in Ga-and Ge-substituted AlFe2B2. J Alloys Compd. 2018 Oct;

44. Franco V, Blázquez J, Ingale B, Conde A. The Magnetocaloric Effect and Magnetic Refrigeration Near Room Temperature: Materials and Models. Annu Rev Mater Res. 2012;42(1):305–42.