Supplementary Material

Compatibility of $LaFe_{13-x-y}Mn_xSi_yH_{1.6}$ and Eutectic Liquid GaInSn Alloy †

Jamieson Brechtl [1,*], Joseph Rendall [1], Mingkan Zhang [1], Michael R. Koehler [2], Kashif Nawaz [1] and Ayyoub M. Momen [3]

[1] Buildings and Transportation Science Division, Oak Ridge National Laboratory, Oak Ridge, TN 37830, USA; rendalljd@ornl.gov (J.R.); zhangm1@ornl.gov (M.Z.); nawazk@ornl.gov (K.N.)
[2] IAMM Diffraction Facility, Institute for Advanced Materials & Manufacturing, University of Tennessee, Knoxville, TN 37920, USA; mkoehler@utk.edu (M.R.K.)
[3] Ultrasonic Technology Solutions, Knoxville, TN 37932, USA; ayyoubmomen@ultratechsol.com (A.M.M.)
* Correspondence: brechtljm@ornl.gov

Table S1. Results of the qualitative and quantitative phase analysis for the as-received magnetocaloric powders S1 – S11.

Sample	Phase	Wt. %	Crystal System	Space Group (No.)	Lattice Parameter (Å)	Volume (Å^3)
S1	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	8.1	Cubic	$Fm\bar{3}c$ (226)	a = 11.60	1,561.16
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	88.2	Cubic	$Fm\bar{3}c$ (226)	a = 11.56	1,544.98
	Mn_3Si	3.1	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.5	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.68
S2	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	22.5	Cubic	$Fm\bar{3}c$ (226)	a = 11.58	1,554.14
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	74.1	Cubic	$Fm\bar{3}c$ (226)	a = 11.56	1,545.55
	Mn_3Si	2.8	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.6	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.68
S3	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	23.0	Cubic	$Fm\bar{3}c$ (226)	a = 11.58	1,554.09
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	73.5	Cubic	$Fm\bar{3}c$ (226)	a = 11.56	1,545.96
	Mn_3Si	3.1	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.4	Hexagonal	$P6_3/m$ (176)	a = 3.94 c = 6.14	82.68
S4	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	31.9	Cubic	$Fm\bar{3}c$ (226)	a = 11.58	1,554.62
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	63.5	Cubic	$Fm\bar{3}c$ (226)	a = 11.57	1,547.61
	Mn_3Si	4.2	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.4	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.68

	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	54.7	Cubic	$Fm\bar{3}c$ (226)	a = 11.58	1,554.52
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	42.3	Cubic	$Fm\bar{3}c$ (226)	a = 11.56	1,545.72
S5	Mn_3Si	2.5	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.4	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.68
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	63.2	Cubic	$Fm\bar{3}c$ (226)	a = 11.59	1,558.82
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	31.8	Cubic	$Fm\bar{3}c$ (226)	a = 11.57	1,549.31
S6	Mn_3Si	4.6	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.4	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.68
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	93.2	Cubic	$Fm\bar{3}c$ (226)	a = 11.51	1,523.27
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	1.5	Cubic	$Fm\bar{3}c$ (226)	a = 11.59	1,558.82
S7	Mn_3Si	4.5	Cubic	$Fm\bar{3}m$ (225)	a = 5.73	188.33
	La_2O_3	0.8	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.40
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	93.8	Cubic	$Fm\bar{3}c$ (226)	a = 11.60	1,560.55
S8	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	1.3	Cubic	$Fm\bar{3}c$ (226)	a = 11.51	1,523.27
	Mn_3Si	4.4	Cubic	$Fm\bar{3}m$ (225)	a = 5.73	188.32
	La_2O_3	0.5	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.40
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	94.3	Cubic	$Fm\bar{3}c$ (226)	a = 11.60	1,561.60
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	0.9	Cubic	$Fm\bar{3}c$ (226)	a = 11.51	1,523.26
S9	Mn_3Si	4.3	Cubic	$Fm\bar{3}m$ (225)	a = 5.73	188.33
	La_2O_3	0.5	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.40
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	93.3	Cubic	$Fm\bar{3}c$ (226)	a = 11.60	1,562.33
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	1.2	Cubic	$Fm\bar{3}c$ (226)	a = 11.51	1,523.27
S10	Mn_3Si	4.9	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.70
	La_2O_3	0.6	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.40
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	93.9	Cubic	$Fm\bar{3}c$ (226)	a = 11.61	1,564.19
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	0.2	Cubic	$Fm\bar{3}c$ (226)	a = 11.51	1,523.27
S11	Mn_3Si	5.5	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.73
	La_2O_3	0.4	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.40

Table S2. Results of the qualitative and quantitative phase analysis for the Galinstan exposed magnetocaloric powders $S1_{mix}$ – $S11_{mix}$.

Sample	Phase	Wt. %	Crystal System	Space Group (No.)	Lattice Parameter (Å)	Volume (Å^3)
$S1_{mix}$	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	55.7	Cubic	$Fm\bar{3}c$ (226)	a = 11.60	1,562.54

	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	36.7	Cubic	$Fm\bar{3}c$ (226)	a = 11.57	1,547.02
	Mn_3Si	2.6	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.6	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.49
	GaO(OH)	4.4	Orthorhombic	Pnma (62)	a = 9.84 b = 2.97 c = 4.58	133.82
$S2_{mix}$	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	78.9	Cubic	$Fm\bar{3}c$ (226)	a = 11.60	1,561.71
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	14.3	Cubic	$Fm\bar{3}c$ (226)	a = 11.57	1,547.64
	Mn_3Si	3.5	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.8	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.49
	GaO(OH)	2.4	Orthorhombic	Pnma (62)	a = 9.84 b = 2.97 c = 4.58	133.81
$S3_{mix}$	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	75.0	Cubic	$Fm\bar{3}c$ (226)	a = 11.61	1,562.95
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	12.2	Cubic	$Fm\bar{3}c$ (226)	a = 11.57	1,547.77
	Mn_3Si	3.1	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.4	Hexagonal	$P6_3/m$ (176)	a = 3.94 c = 6.14	82.68
	GaO(OH)	9.3	Orthorhombic	Pnma (62)	a = 9.83 b = 2.97 c = 4.59	133.89
$S4_{mix}$	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	79.3	Cubic	$Fm\bar{3}c$ (226)	a = 11.60	1,561.95
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	11.0	Cubic	$Fm\bar{3}c$ (226)	a = 11.57	1,548.18
	Mn_3Si	1.9	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.5	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.68
	GaO(OH)	7.3	Orthorhombic	Pnma (62)	a = 9.83 b = 2.97 c = 4.59	134.02
$S5_{mix}$	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	90.9	Cubic	$Fm\bar{3}c$ (226)	a = 11.61	1,567.71
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	0.3	Cubic	$Fm\bar{3}c$ (226)	a = 11.57	1,548.30
	Mn_3Si	2.0	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.5	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.68
	GaO(OH)	6.3	Orthorhombic	Pnma (62)	a = 9.83 b = 2.97 c = 4.58	133.93
$S6_{mix}$	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	87.2	Cubic	$Fm\bar{3}c$ (226)	a = 11.61	1,565.01
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	0.2	Cubic	$Fm\bar{3}c$ (226)	a = 11.57	1,548.30
	Mn_3Si	1.8	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.5	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94	82.68

					c = 6.14	
					a = 9.83	
	GaO(OH)	10.3	Orthorhombic	Pnma (62)	b = 2.97	133.91
					c = 4.59	
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	86.5	Cubic	$Fm\bar{3}c$ (226)	a = 11.61	1,563.43
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ II	1.9	Cubic	$Fm\bar{3}c$ (226)	a = 11.55	1,542.22
	Mn_3Si	2.0	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
$S7_{mix}$	La_2O_3	0.5	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.68
					a = 9.83	
	GaO(OH)	9.1	Orthorhombic	Pnma (62)	b = 2.97	133.95
					c = 4.59	
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	94.8	Cubic	$Fm\bar{3}c$ (226)	a = 11.61	1,564.28
	Mn_3Si	2.4	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
$S8_{mix}$	La_2O_3	0.5	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.68
					a = 9.83	
	GaO(OH)	2.2	Orthorhombic	Pnma (62)	b = 2.97	133.97
					c = 4.59	
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	92.1	Cubic	$Fm\bar{3}c$ (226)	a = 11.61	1,565.36
	Mn_3Si	2.7	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.5	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.68
$S9_{mix}$					a = 9.83	
	GaO(OH)	4.4	Orthorhombic	Pnma (62)	b = 2.97	133.97
					c = 4.59	
	GaSb	0.3	Cubic	$F4\bar{3}m$	a = 6.11	228.10
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	92.5	Cubic	$Fm\bar{3}c$ (226)	a = 11.62	1,568.78
	Mn_3Si	2.5	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.5	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.68
$S10_{mix}$					a = 9.83	
	GaO(OH)	4.1	Orthorhombic	Pnma (62)	b = 2.97	133.97
					c = 4.59	
	GaSb	0.3	Cubic	$F4\bar{3}m$	a = 6.11	228.10
	$LaFe_{11.31}Si_{1.69}H_{1.51}$ I	87.3	Cubic	$Fm\bar{3}c$ (226)	a = 11.61	1,565.84
	Mn_3Si	2.5	Cubic	$Fm\bar{3}m$ (225)	a = 5.74	188.72
	La_2O_3	0.4	Hexagonal	$P\bar{3}m1$ (164)	a = 3.94 c = 6.14	82.68
$S11_{mix}$					a = 9.83	
	GaO(OH)	8.3	Orthorhombic	Pnma (62)	b = 2.97	133.81
					c = 4.58	
	GaSb	0.9	Cubic	$F4\bar{3}m$	a = 6.11	228.10
	$LaMn_{0.87}Sb_2$	0.6	Tetragonal	P4/nmm	a = 4.47 c = 10.65	212.89