Differential Scanning calorimetry under applyed fields: Entropy Changes in caloric materials

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Motivation:

VOLUME 83, NUMBER 11 PHYSICAL REVIEW LETTERS 13 SEPTEMBER 1999

Direct Measurement of the "Giant" Adiabatic Temperature Change in $Gd_5Si_2Ge_2$

A. Giguère,[1,*] M. Foldeaki,[1,†] B. Ravi Gopal,[1,‡] R. Chahine,[1] T. K. Bose,[1] A. Frydman,[2] and J. A. Barclay[2]
[1]*Institut de recherche sur l'hydrogène, Université du Québec à Trois-Rivières, Trois-Rivières, Québec, Canada*
[2]*University of Victoria, Victoria, British Columbia, Canada*
(Received 23 November 1998)

VOLUME 85, NUMBER 19 PHYSICAL REVIEW LETTERS 6 NOVEMBER 2000

Comment on "Direct Measurement of the 'Giant' Adiabatic Temperature Change in $Gd_5Si_2Ge_2$"

K. A. Gschneidner, Jr.,[1] V. K. Pecharsky,[1] E. Brück,[2]
H. G. M. Duijn,[2] and E. M. Levin[3]
[1]Ames Laboratory
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Iowa State University, Ames, Iowa 50011-3020
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VOLUME 85, NUMBER 19 PHYSICAL REVIEW LETTERS 6 NOVEMBER 2000

Comment on "Direct Measurement of the 'Giant' Adiabatic Temperature Change in $Gd_5Si_2Ge_2$"

J. R. Sun, F. X. Hu, and B. G. Shen
State Key Laboratory for Magnetism, Institute of Physics
and Center for Condensed Matter Physics
Chinese Academy of Sciences
Beijing 100080, People's Republic of China

Further (latter) motivation:

LETTERS

Ambient pressure colossal magnetocaloric effect tuned by composition in $Mn_{1-x}Fe_xAs$

ARIANA DE CAMPOS[1], DANIEL L ROCCO[1], ALEXANDRE MAGNUS G. CARVALHO[1], LUANA CARON[1], ADELINO A. COELHO[1], SERGIO GAMA[1]*, LUZELI M. DA SILVA[1], FLÁVIO C. G. GANDRA[1], ADENILSON O. DOS SANTOS[1], LISANDRO P. CARDOSO[1], PEDRO J. VON RANKE[2] AND NILSON A. DE OLIVEIRA[2]

[1]Instituto de Física Gleb Wataghin, Universidade Estadual de Campinas - UNICAMP, Caixa Postal 6165, 13083-970 Campinas, S. Paulo, Brazil
[2]Instituto de Física, Universidade do Estado do Rio de Janeiro—UERJ, Rua São Francisco Xavier, 524, 20550-013, RJ, Brazil
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nature materials | VOL 5 | OCTOBER 2006 | www.nature.com/naturematerials

APPLIED PHYSICS LETTERS **90**, 032507 (2007)

Determination of the entropy changes in the compounds with a first-order magnetic transition

G. J. Liu and J. R. Sun[a)]
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J. Shen
State Key Laboratory for Magnetism, Institute of Physics and Center for Condensed Matter Physics, Chinese Academy of Sciences, Beijing 100080, People's Republic of China and School of Materials Science and Engineering, Hebei University of Technology, Tianjin 300130, People's Republic of China

B. Gao, H. W. Zhang, F. X. Hu, and B. G. Shen
State Key Laboratory for Magnetism, Institute of Physics and Center for Condensed Matter Physics, Chinese Academy of Sciences, Beijing 100080, People's Republic of China

Journal of Magnetism and Magnetic Materials 321 (2009) 3559–3566

Contents lists available at ScienceDirect

Journal of Magnetism and Magnetic Materials

journal homepage: www.elsevier.com/locate/jmmm

Current Perspectives

On the determination of the magnetic entropy change in materials with first-order transitions

L. Caron[a,b], Z.Q. Ou[b,c], T.T. Nguyen[b], D.T. Cam Thanh[b], O. Tegus[b,c], E. Brück[b,*]

[a] *Instituto de Física Gleb Wataghin, Universidade Estadual de Campinas-UNICAMP, C.P. 6165, Campinas 13 083 970, SP, Brazil*
[b] *Fundamental Aspects of Energy and Materials, Faculty of Applied Science, TU Delft, Mekelweg 15, 2629 JB Delft, The Netherlands*
[c] *Key Laboratory for Physics and Chemistry of Functional Materials, Inner Mongolia Normal University, Hohhot 010022, PR China*

JOURNAL OF APPLIED PHYSICS **105**, 093918 (2009)

Entropy determinations and magnetocaloric parameters in systems with first-order transitions: Study of MnAs

Leticia Tocado,[a)] Elías Palacios, and Ramón Burriel
Departamento de Física de la Materia Condensada, Instituto de Ciencia de Materiales de Aragón, CSIC-Universidad de Zaragoza, Pedro Cerbuna 12, 50009 Zaragoza, Spain

Best suited technique to determine entropy changes at phase transitions?

↓

CALORIMETRY

Second order phase transitions

Adiabatic,
Relaxational,
AC calorimetry,
....

} C_p

First-order phase transitions

Best suited technique to determine entropy changes at phase transitions?

CALORIMETRY

Second order phase transitions

Adiabatic,
Relaxational,
AC calorimetry,
....

C_p

First-order phase transitions

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Cryogenics 43 (2003) 369–378

Cryogenics

www.elsevier.com/locate/cryogenics

Critical examination of heat capacity measurements made on a Quantum Design physical property measurement system ☆

J.C. Lashley [a,*], M.F. Hundley [a], A. Migliori [a], J.L. Sarrao [a], P.G. Pagliuso [a], T.W. Darling [a], M. Jaime [a], J.C. Cooley [a], W.L. Hults [a], L. Morales [a], D.J. Thoma [a], J.L. Smith [a], J. Boerio-Goates [b], B.F. Woodfield [b], G.R. Stewart [c], R.A. Fisher [d], N.E. Phillips [d]

[a] *Materials Science and Technology Division, Los Alamos National Laboratory, P.O. Box 1663 MST-8, MS G721, Los Alamos, NM 87545, USA*
[b] *Department of Chemistry and Biochemistry, Brigham Young University, Provo, UT 84602, USA*
[c] *Department of Physics, University of Florida, Gainesville, FL 32611-8440, USA*
[d] *Lawrence Berkeley National Laboratory, University of California, Berkeley, CA 94720, USA*

Best suited technique to determine entropy changes at phase transitions?

CALORIMETRY

Second order phase transitions

Adiabatic,
Relaxational,
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....

C_p

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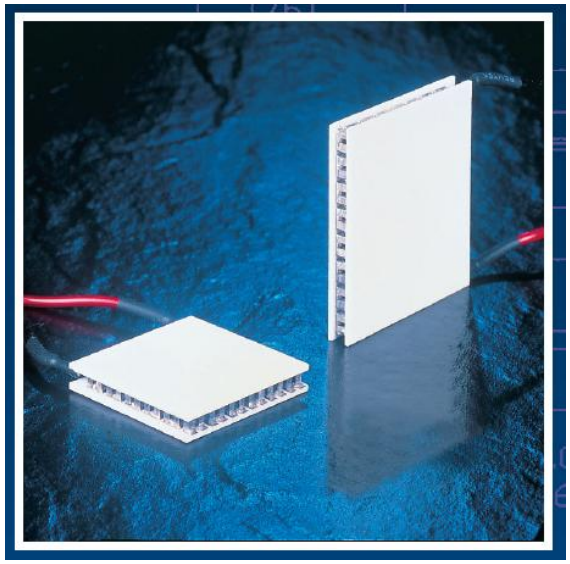
[b] Department of Chemistry and Biochemistry, Brigham Young University, Provo, UT 84602, USA
[c] Department of Physics, University of Florida, Gainesville, FL 32611-8440, USA
[d] Lawrence Berkeley National Laboratory, University of California, Berkeley, CA 94720, USA

Differential Scanning Calorimetry (DSC)

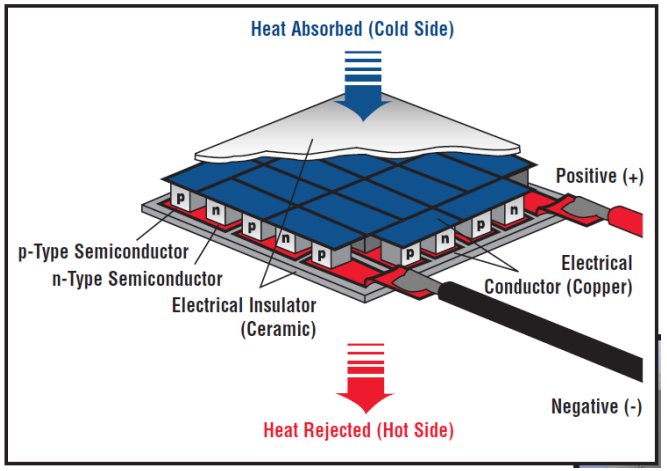
Heat flux dQ/dt

PURPOSE-BUILT DSC CALORIMETERS

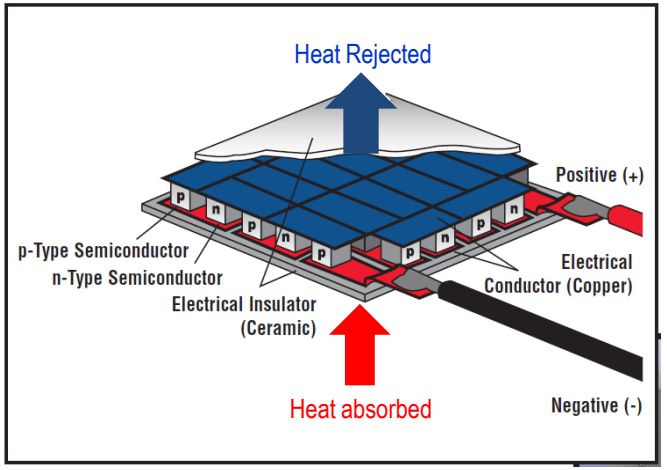
Peltier cells.



Thermoelectric cooler



Heat fluxmeter



A BIT OF HISTORY

C. R. Acad. Sc. Paris, t. 266, p. 113-114 (15 janvier 1968). Série B

CALORIMÉTRIE. — *Contribution à l'étude calorimétrique des transformations solide-solide.* Note (*) de Mme Annie Géry, MM. Gilbert Sinicki, Michel Laurent et Jean-Luc Macqueron, présentée par M. Gaston Dupouy.

Un calorimètre différentiel à conduction est décrit. Il a permis de mesurer l'énergie dégagée au cours de la transformation martensitique d'un alliage Fe-Ni. Le caractère essentiellement discontinu de ce dégagement a été mis en évidence.

Dans le but d'évaluer l'énergie dissipée lors d'une transformation martensitique [(1), (2), (3)], l'appareil représenté sur la figure 1 a été réalisé. L'échantillon, sous forme de plaquette d'épaisseur 1,5 mm, est inséré entre deux disques en cuivre comportant chacun une résistance d'éta-

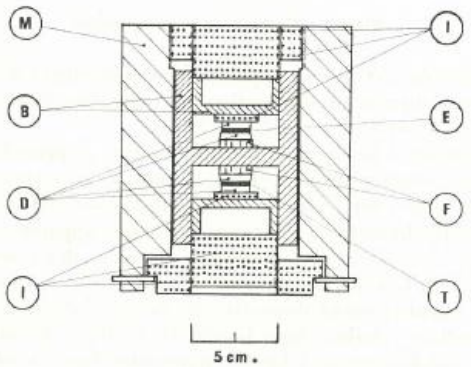


Fig. 1.

M, masse écran en laiton; B, bloc répartiteur de température en cuivre; D, disques d'étalonnage; I, isolants thermiques; E, échantillon; F, fluxmètres; T, échantillon témoin.

lonnage. L'un de ces disques est relié thermiquement à un bloc répartiteur de température par l'intermédiaire d'un fluxmètre. Un échantillon de même matière, préalablement transformé, monté de façon identique confère la symétrie nécessaire à ce dispositif d'analyse thermique quantitative. Les fluxmètres sont des piles thermoélectriques à semi-conducteurs fournissant une f. é. m. thermique de 65 μV/mW à 25°C. Cette f. é. m. varie linéairement avec la température entre — 180 et 25°C [(4), (5)]. Une masse importante de laiton exerce sur les divers éléments la pression

THE

ORIGINS

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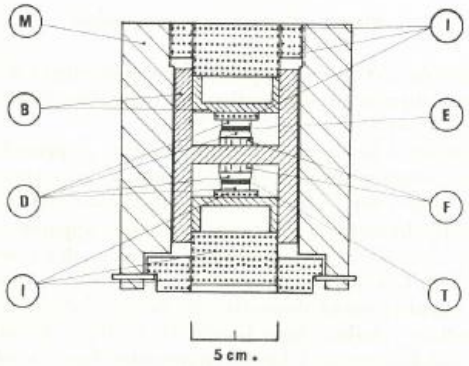

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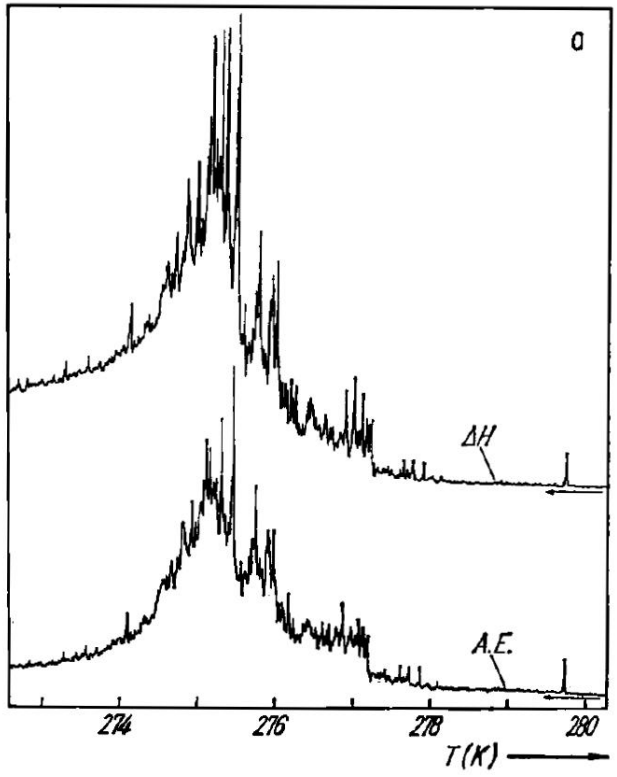
phys. stat. sol. (a) 66, 717 (1981)

Subject classification: 1.2 and 7; 21; 21.1

Laboratoire de Traitement du Signal et Ultrasons (a) and
Groupe d'Etudes de Métallurgie Physique et Physique des Matériaux (b),
Equipe de recherche associée au Centre National de la „Recherche Scientifique 463",
Institut National des Sciences Appliquées, Villeurbanne[1])

Study of Martensitic Transformation of Cu–Zn–Al Alloy by Coupled Enthalpy and Acoustic Emission Measurements

By
A. Planes[2]) (a), J. L. Macqueron (a), M. Morin (b), and G. Guenin (b)



Low-cost differential scanning calorimeter

Am. J. Phys. **64** (3), March 1996

Lluís Mañosa, Marc Bou, Carme Calles, and Albert Cirera
Departament d'Estructura i Constituents de la Matèria, Universitat de Barcelona, Diagonal 647, Facultat de Física, E-08028 Barcelona, Catalonia, Spain

(Received 28 November 1994; accepted 28 March 1995)

We present a simple and inexpensive calorimetric system that has been implemented in the undergraduate students laboratory of thermodynamics at the Physics Faculty of the University of Barcelona. It is shown that, after proper calibration, the system enables measurement of the relevant thermodynamic quantities at a first-order phase transition. As an example, the solid–liquid phase transition of water can be studied: Students find that both the change in specific heat and the latent heat (and its temperature dependence) coincide within the experimental scatter with the values given in the literature.

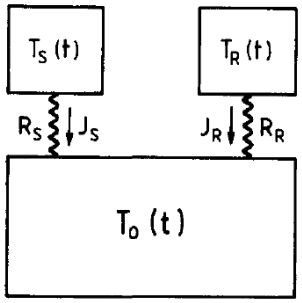
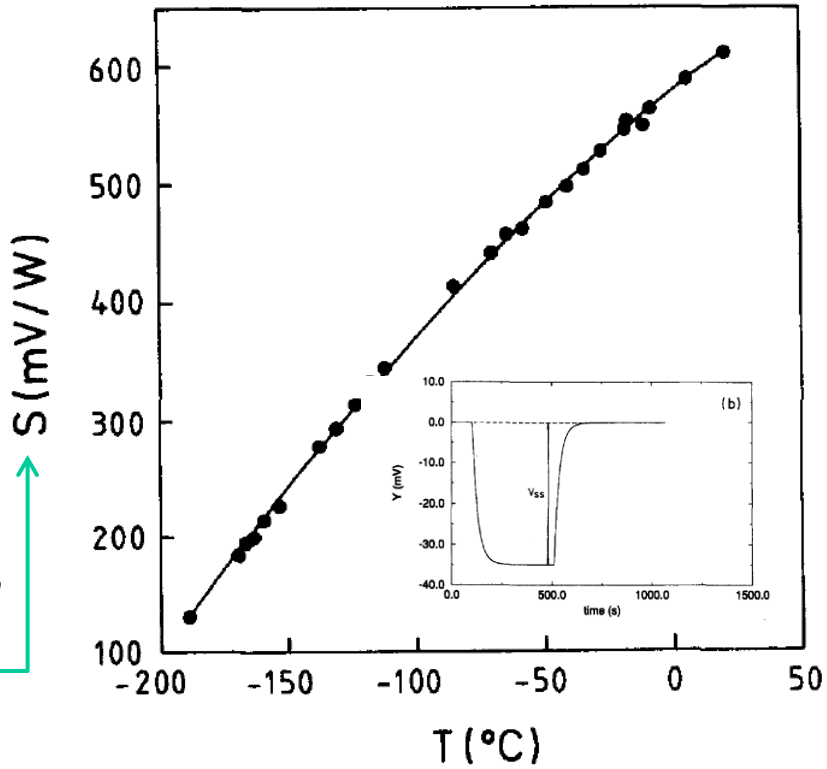
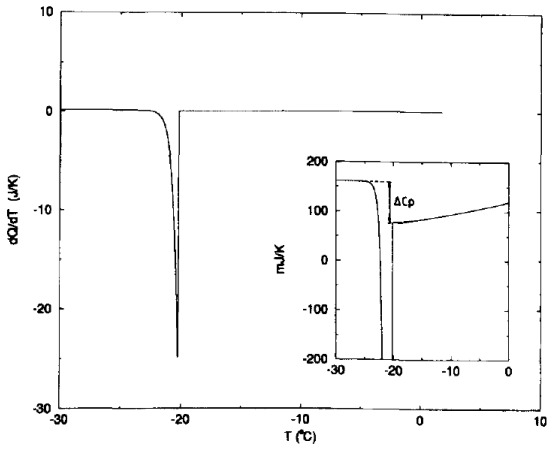


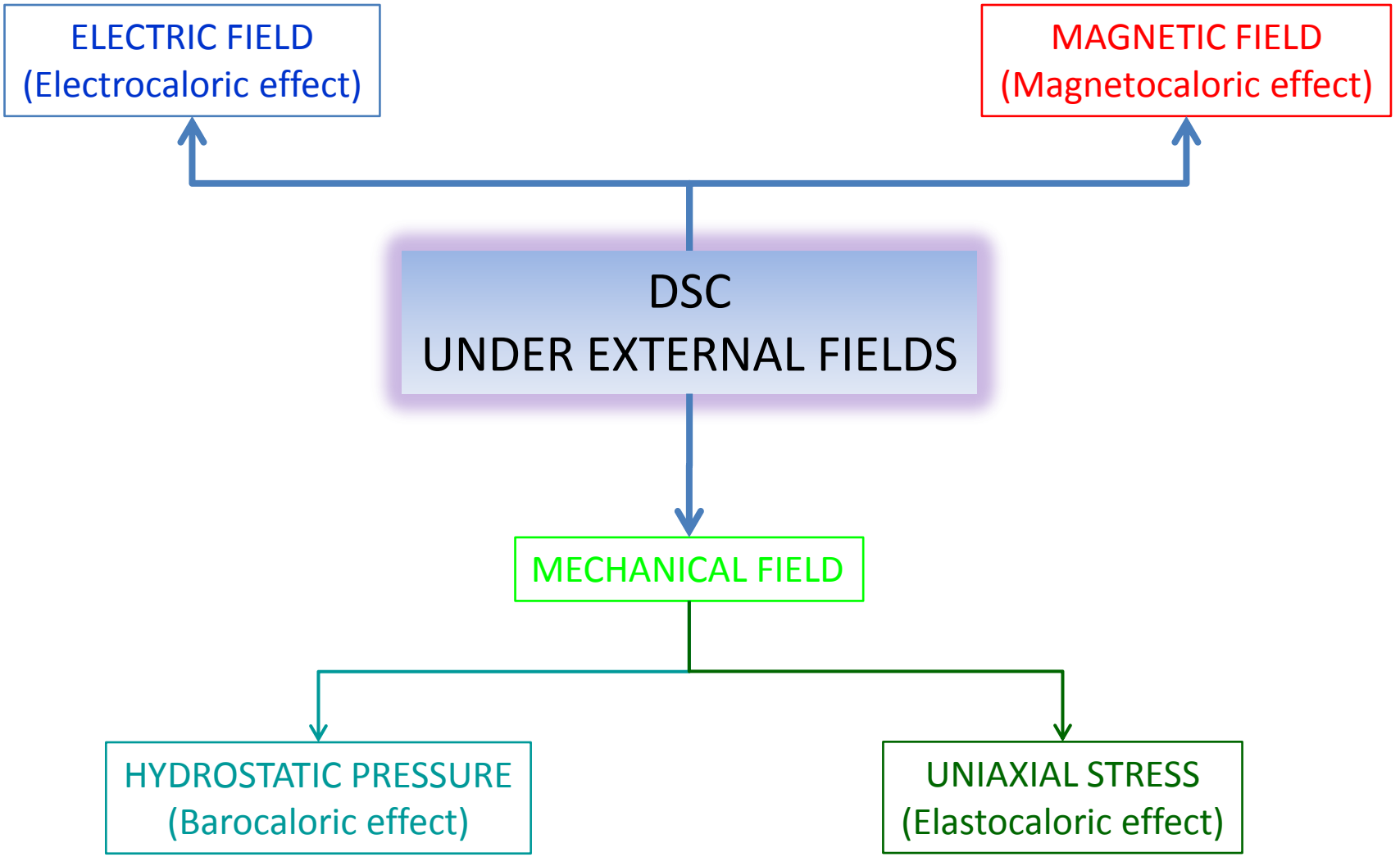
Fig. 1. Sketch of a typical DSC.

$$Y(t)=S\left[-\frac{dh}{dt}+(C_S-C_R)\dot{T}_0\right],$$



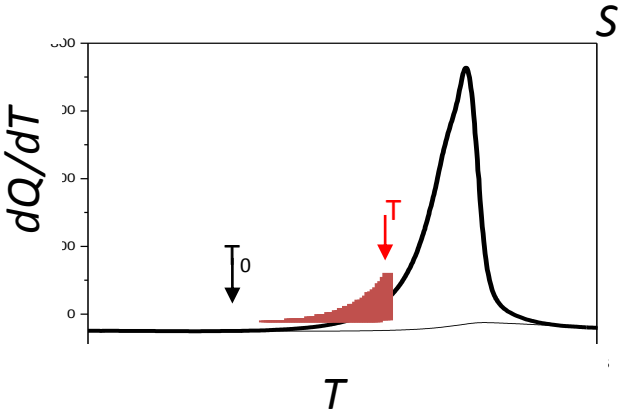


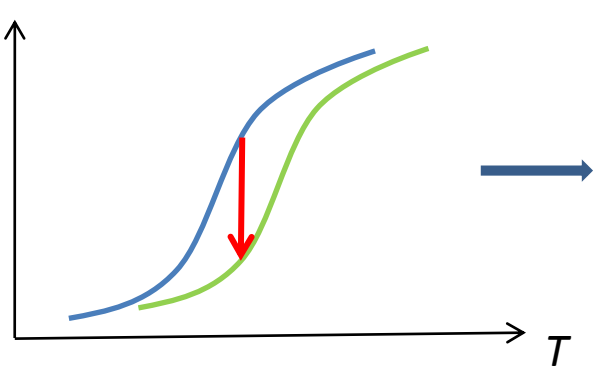
Water freezing

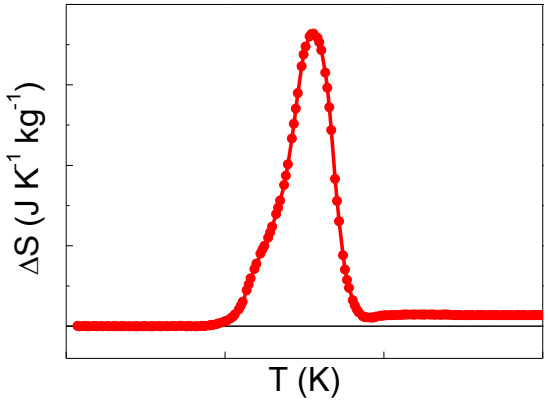

ELECTRIC FIELD
(Electrocaloric effect)
MAGNETIC FIELD
(Magnetocaloric effect)
DSC
UNDER EXTERNAL FIELDS
MECHANICAL FIELD
HYDROSTATIC PRESSURE
(Barocaloric effect)
UNIAXIAL STRESS
(Elastocaloric effect)

Computing caloric effects: Field-induced entropy change

DSC Calorimetry under constant field (Y), sweeping temperature (T) : **QUASI-DIRECT METHOD**

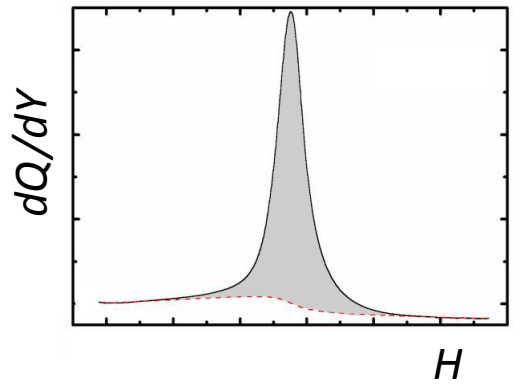




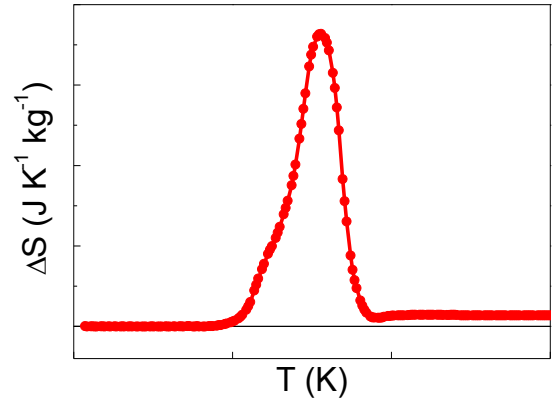


$$S(T,Y) - S(T_0,Y) = \int_{T_0}^{T} \frac{1}{T}\frac{dQ}{dT}dT \qquad \Delta S(0 \to Y) = S(T,Y) - S(T,0)$$

DSC Calorimetry under constant temperature (T), sweeping field (Y): **DIRECT METHOD**

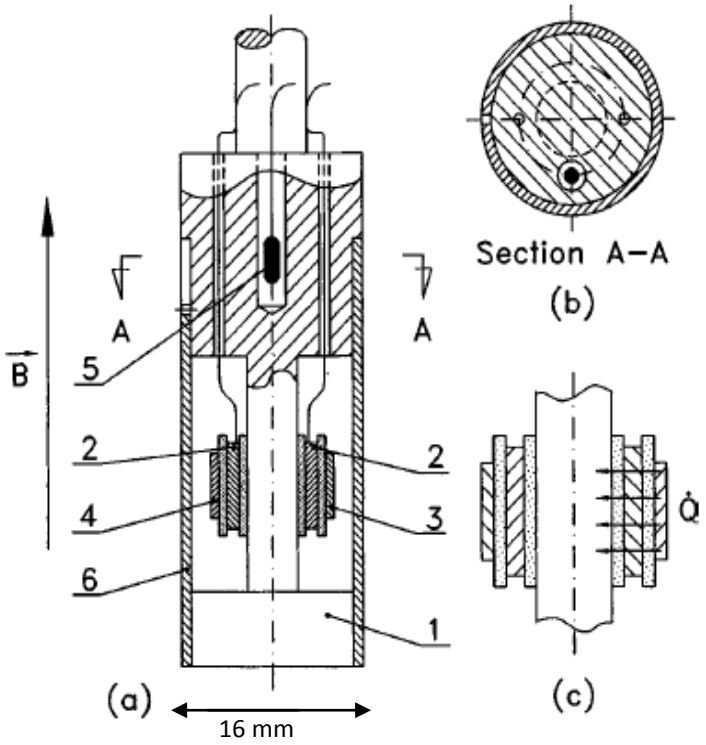


$$\Delta S(0 \to Y) = \frac{1}{T}\int_0^Y \frac{dQ}{dY}dY$$



DSC WITH MAGNETIC FIELD v1

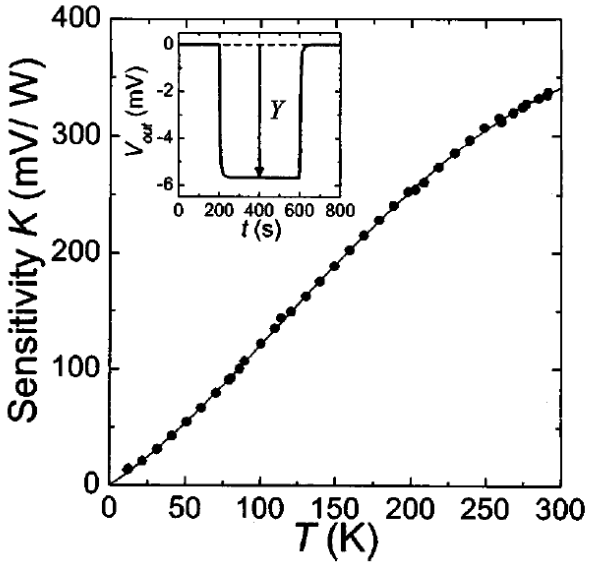
Marcos *et al.*, Rev. Sci. Inst. **74**, 4768 (2003)



1 Cu block
2 Sensors (thermobatteries)
3 Sample
4 Reference
5 Carbon-glass resistor (*T*)

T: 10 – 300 K

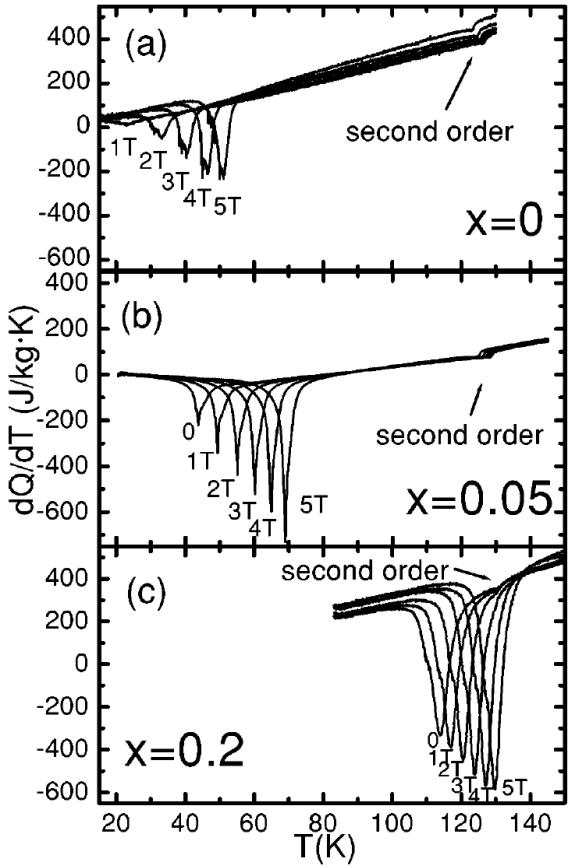
B: 0 – 5 T



Illustrative examples of thermal curves

Isofield, scanning T

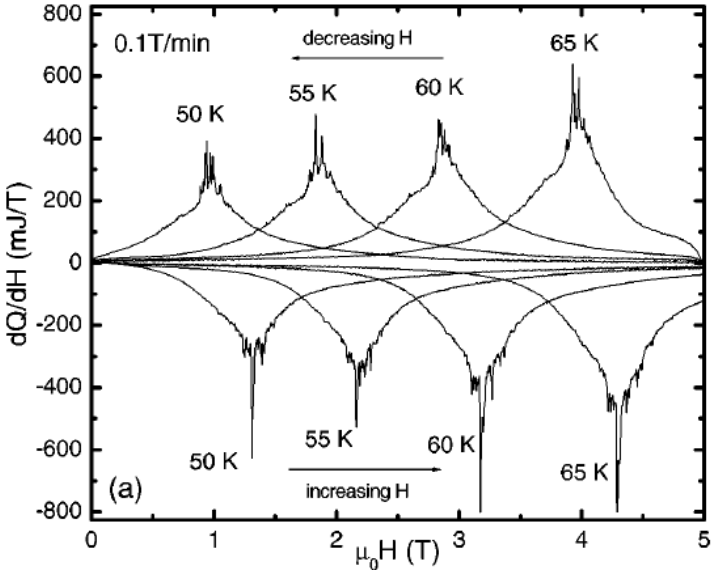
$Gd_5(Si_xGe_{1-x})_4$



Casanova *et al.*,
Phys. Rev. B. **69**, 104416 (2004)

Isothermal, scanning H

$Gd_5(Si_{0.05}Ge_{0.95})_4$

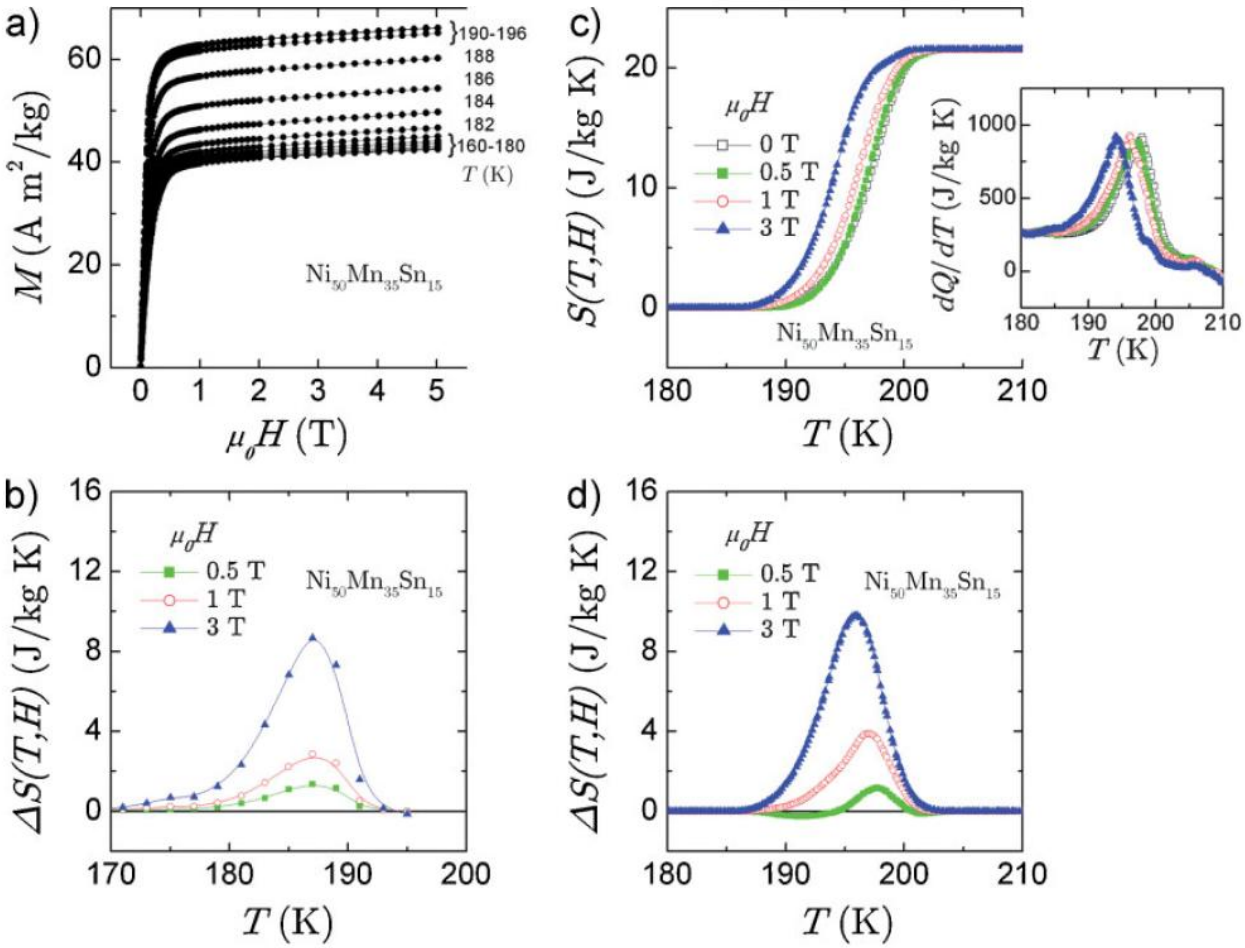


Casanova *et al.*,
Appl. Phys. Lett. **86**, 262504 (2005)

Adv. Mater. **2009**, *21*, 3725–3726

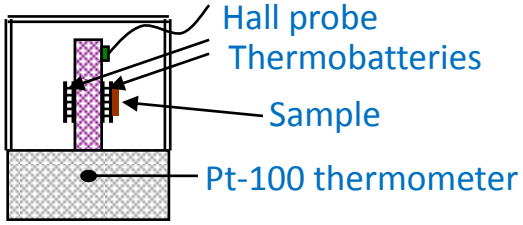
Comment on "The Magnetocaloric Effect of $LaFe_{11.6}Si_{1.4}$, $La_{0.8}Nd_{0.2}Fe_{11.5}Si_{1.5}$, and $Ni_{43}Mn_{46}Sn_{11}$ Compounds in the Vicinity of the First-Order Phase Transition"

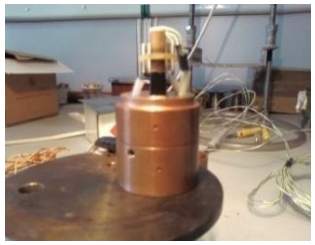
By *Lluís Mañosa,* Antoni Planes,* and *Xavier Moya*

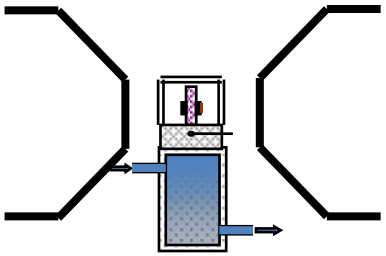


DSC WITH MAGNETIC FIELD v2

v2.0



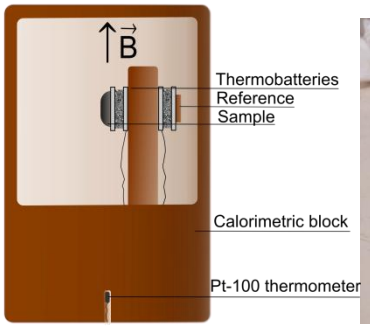




T: 100 – 400 K

B: 0 – 1 T

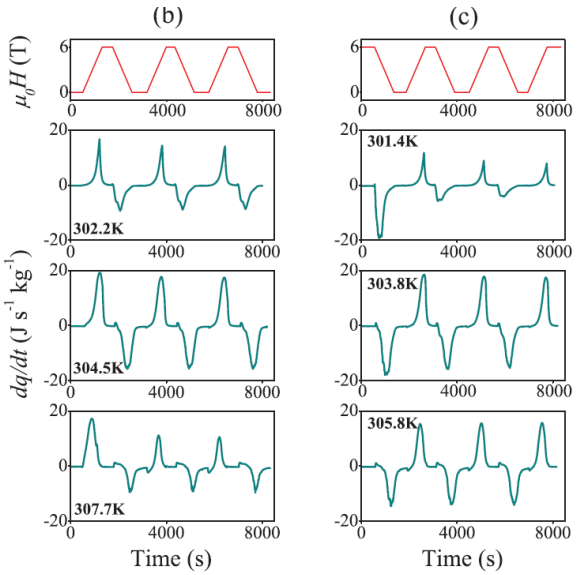
v2.1



T: 100 – 400 K

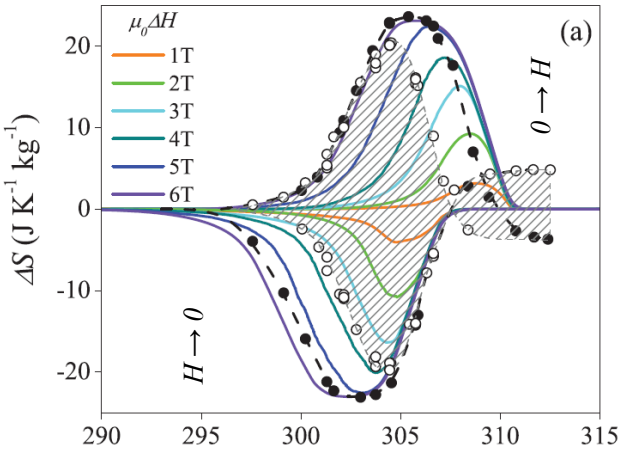
B: 0 – 6 T

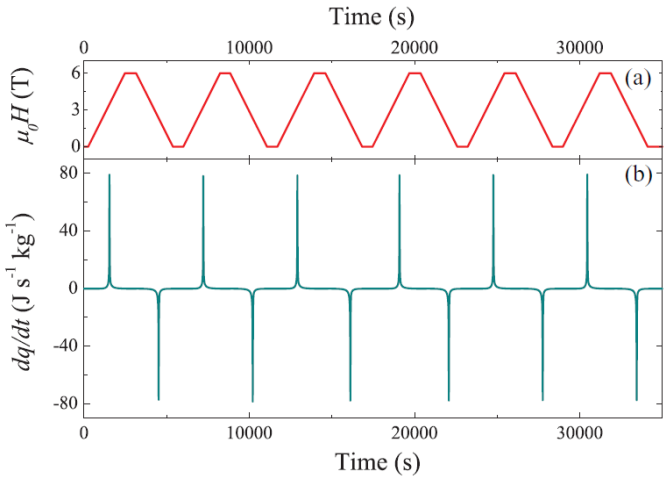
Examples: Reproducibility of ΔS upon field cycling.



$Ni_{51}Mn_{33.4}In_{15.6}$

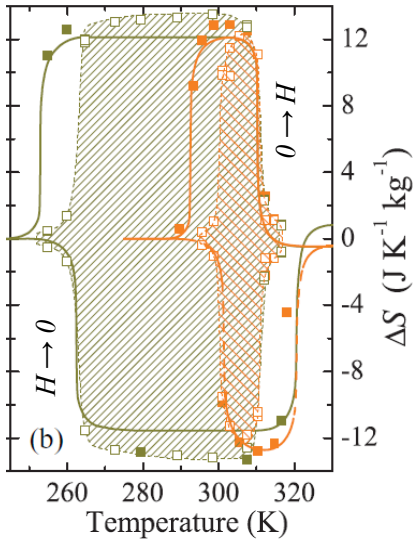
Stern-Taulats et al.
J. Appl. Phys. 115 (2014) 173907





$Fe_{49}Rh_{51}$

Stern-Taulats et al.
Phys. Rev. B 89 (2014) 214105



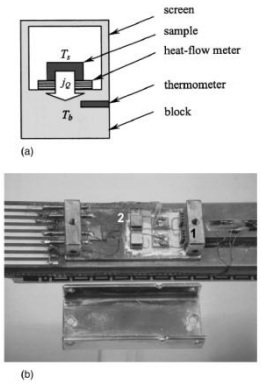
OTHER (PELTIER CELL) DEVICES

REVIEW OF SCIENTIFIC INSTRUMENTS VOLUME 73, NUMBER 7 JULY 2002

Specific heat and magnetocaloric effect measurements using commercial heat-flow sensors

Tomasz Plackowski
Département de Physique de la Matière Condensée, Université de Genève, CH-1211 Genève 4, Switzerland, and Institute of Low Temperature & Structure Research, 50-950 Wrocław 2, P. O. Box 1410, Poland

Yuxing Wang and Alain Junod
Département de Physique de la Matière Condensée, Université de Genève, CH-1211 Genève 4, Switzerland

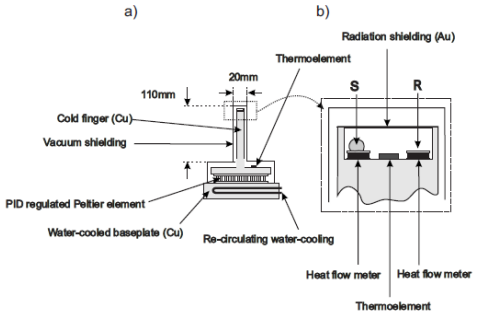


REVIEW OF SCIENTIFIC INSTRUMENTS **79**, 083901 (2008)

Indirect measurement of the magnetocaloric effect using a novel differential scanning calorimeter with magnetic field

S. Jeppesen,[a] S. Linderoth, N. Pryds, L. Theil Kuhn, and J. Buch Jensen
Fuel Cells and Solid State Chemistry Department, Risø DTU, Technical University of Denmark, DK-4000 Roskilde, Denmark

(Received 10 April 2008; accepted 20 June 2008; published online 5 August 2008)



REVIEW OF SCIENTIFIC INSTRUMENTS **79**, 063907 (2008)

A Peltier cell calorimeter for the direct measurement of the isothermal entropy change in magnetic materials

Vittorio Basso,[a] Michaela Küpferling, Carlo P. Sasso, and Laura Giudici[b]
Istituto Nazionale di Ricerca Metrologica, Strada delle Cacce 91, 10135 Torino, Italy

(Received 21 December 2007; accepted 18 May 2008; published online 19 June 2008)

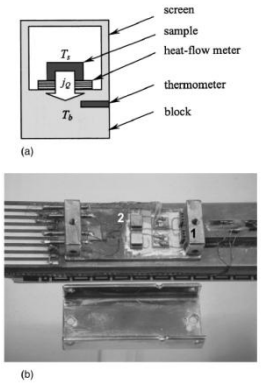
OTHER (PELTIER CELL) DEVICES

REVIEW OF SCIENTIFIC INSTRUMENTS VOLUME 73, NUMBER 7 JULY 2002

Specific heat and magnetocaloric effect measurements using commercial heat-flow sensors

Tomasz Plackowski
Département de Physique de la Matière Condensée, Université de Genève, CH-1211 Genève 4, Switzerland, and Institute of Low Temperature & Structure Research, 50-950 Wrocław 2, P. O. Box 1410, Poland

Yuxing Wang and Alain Junod
Département de Physique de la Matière Condensée, Université de Genève, CH-1211 Genève 4, Switzerland

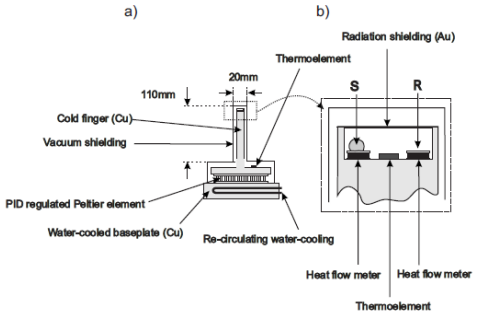


REVIEW OF SCIENTIFIC INSTRUMENTS **79**, 083901 (2008)

Indirect measurement of the magnetocaloric effect using a novel differential scanning calorimeter with magnetic field

S. Jeppesen,[a] S. Linderoth, N. Pryds, L. Theil Kuhn, and J. Buch Jensen
Fuel Cells and Solid State Chemistry Department, Risø DTU, Technical University of Denmark, DK-4000 Roskilde, Denmark

(Received 10 April 2008; accepted 20 June 2008; published online 5 August 2008)



REVIEW OF SCIENTIFIC INSTRUMENTS **79**, 063907 (2008)

A Peltier cell calorimeter for the direct measurement of entropy change in magnetic materials

Vittorio Basso,[a] Michaela Küpferling, Carlo P. Sasso, and Laura Giudici[b]
Istituto Nazionale di Ricerca Metrologica, Strada delle Cacce 91, 10135 Torino, Italy

(Received 21 December 2007; accepted 18 May 2008; published online 19 June 2

PHYSICAL REVIEW B **86**, 104432 (2012)

Convergence of direct and indirect methods in the magnetocaloric study of first order transformations: The case of Ni-Co-Mn-Ga Heusler alloys

G. Porcari,[1,*] F. Cugini,[1] S. Fabbrici,[2,3] C. Pernechele,[1] F. Albertini,[3] M. Buzzi,[1,†] M. Mangia,[4] and M. Solzi[1]
[1]*Dipartimento di Fisica and CNISM, Università di Parma, viale G. P. Usberti 7/A, I-43100 Parma, Italy*
[2]*MIST E-R Laboratory, via Gobetti 101, I-40129 Bologna, Italy*
[3]*IMEM-CNR, Parco Area delle Scienze 37/A, I-43100 Parma, Italy*
[4]*BioPharmaNet, Department of Pharmacy, University of Parma, viale G. P. Usberti 27/A, Parma, Italy*
(Received 10 July 2012; published 27 September 2012)

OTHER DEVICES

Journal of Thermal Analysis and Calorimetry, Vol. 84 (2006) 1, 213–217

ADIABATIC MEASUREMENT OF THE GIANT MAGNETOCALORIC EFFECT IN MnAs

Leticia Tocado, E. Palacios and R. Burriel*

Instituto de Ciencia de Materiales de Aragón, CSIC – Universidad de Zaragoza, Pedro Cerbuna 12, 50009 Zaragoza, Spain

APPLIED PHYSICS LETTERS **107**, 092403 (2015)

Entropy change of a $Ni_{45.5}Co_{4.5}Mn_{37}In_{13}$ single crystal studied by scanning calorimetry in high magnetic fields: Field dependence of the magnetocaloric effect

D. Bourgault,[1,2,a)] L. Porcar,[1,2] S. Rivoirard,[3,4] P. Courtois,[5] and V. Hardy[6]
[1]*CNRS, Inst. NEEL, F-38000 Grenoble, France*
[2]*Univ. Grenoble Alpes, Inst. NEEL, F-38042 Grenoble Cedex 9, France*
[3]*CNRS, CRETA, F-38000 Grenoble, France*
[4]*Univ. Grenoble Alpes, CRETA, F-38000 Grenoble, France*
[5]*Institut Laue Langevin, 38000 Grenoble, France*
[6]*Laboratoire CRISMAT, CNRS UMR 6508, 6 Boulevard Maréchal Juin, 14050 Caen Cedex, France*

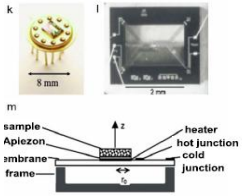
(Received 2 June 2015; accepted 21 August 2015; published online 1 September 2015)

REVIEW OF SCIENTIFIC INSTRUMENTS **79**, 074901 (2008)

Heat capacity and latent heat measurements of CoMnSi using a microcalorimeter

Y. Miyoshi, K. Morrison, J. D. Moore, A. D. Caplin, and L. F. Cohen
Blackett Laboratory, Imperial College London, London SW7 2BZ, United Kingdom

(Received 11 March 2008; accepted 24 June 2008; published online 31 July 2008)



REVIEW OF SCIENTIFIC INSTRUMENTS **83**, 083902 (2012)

Practical system for the direct measurement of magneto-caloric effect by micro-thermocouples

J. Kamarád,[1,a)] J. Kaštil,[2] and Z. Arnold[1]
[1]*Institute of Physics ASCR, v.v.i., Na Slovance 2, 182 21 Praha 8, Czech Republic*
[2]*Charles University in Prague, Faculty of Mathematics and Physics, Ke Karlovu 5, 121 16 Praha 2, Czech Republic*

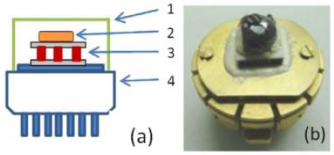
(Received 17 May 2012; accepted 16 July 2012; published online 2 August 2012)

APPLIED PHYSICS LETTERS **105**, 074104 (2014)

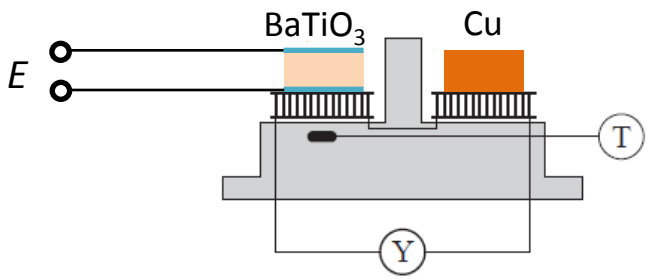
Determination of the magnetocaloric entropy change by field sweep using a heat flux setup

J. C. B. Monteiro,[a)] R. D. dos Reis, A. M. Mansanares, and F. G. Gandra
Universidade Estadual de Campinas, Instituto de Fisica Gleb Wataghin, Campinas, SP 13083-859, Brazil

(Received 16 July 2014; accepted 11 August 2014; published online 21 August 2014)



DSC WITH ELECTRIC FIELD



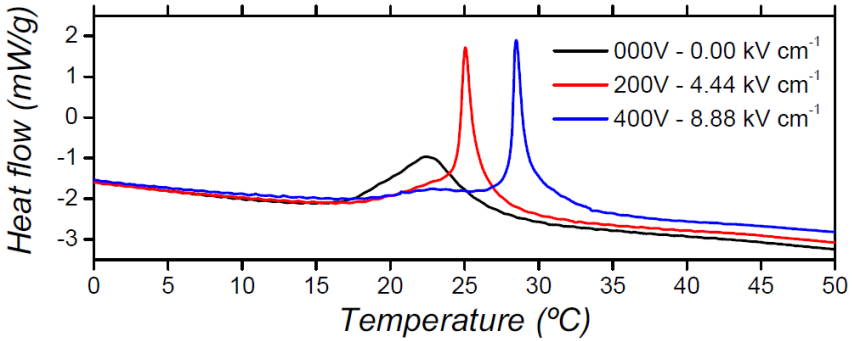
T: 100 – 400 K

V: 0 – 2kV

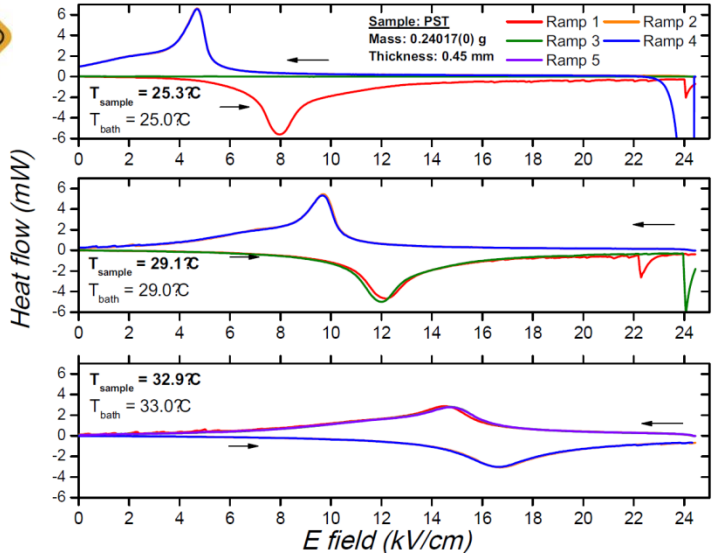
Illustrative examples of thermograms

$PbSc_{0.5}Ta_{0.5}O_3$

Isofield, scanning T



Isothermal, scanning E



Examples

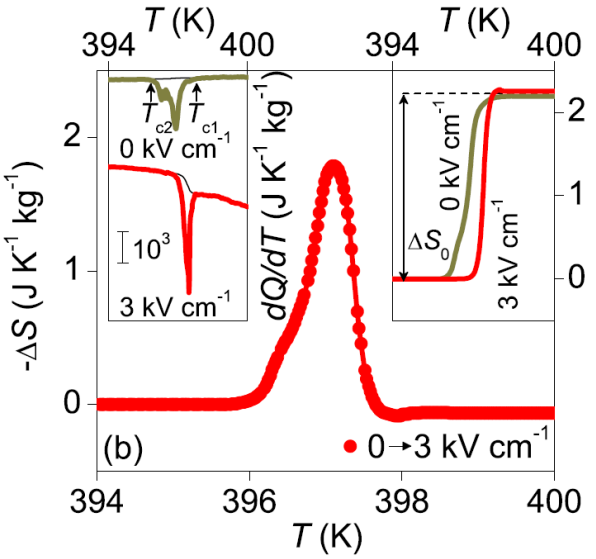
ADVANCED MATERIALS
www.advmat.de

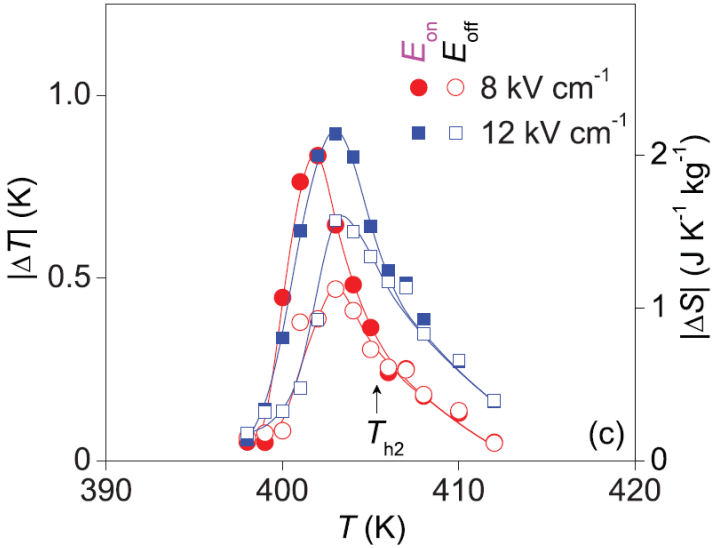
Materials Views
www.MaterialsViews.com

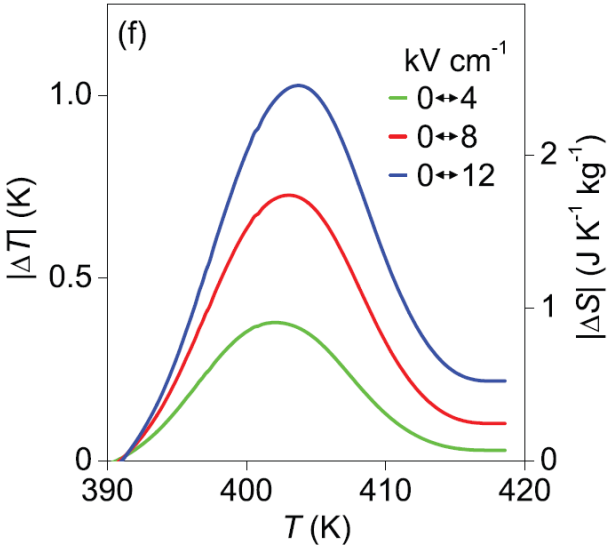
Giant Electrocaloric Strength in Single-Crystal $BaTiO_3$

Xavier Moya, Enric Stern-Taulats, Sam Crossley, David González-Alonso, Sohini Kar-Narayan, Antoni Planes, Lluís Mañosa, and Neil D. Mathur**

Adv. Mater. **2013**, *25*, 1360–1365







OTHER DSC WITH ELECTRIC FIELD

Journal of Thermal Analysis and Calorimetry, Vol. 81 (2005) 41–44

LATENT HEAT STUDY OF PHASE TRANSITION IN $Ba_{0.73}Sr_{0.27}TiO_3$ INDUCED BY ELECTRIC FIELD

G. C. Lin[1], *X. M. Xiong*[1], *J. X. Zhang*[1*] *and Q. Wei*[2]

[1]State Key Laboratory of Optoelectronic Materials and Technologies, Zhongshan University, Guangzhou 510275, P.R. China
[2]Guangzhou Communication Institute, Guangzhou 510310, P.R. China

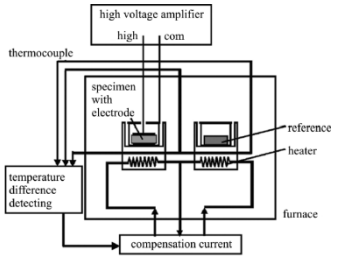
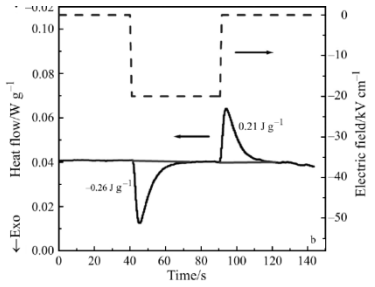


Fig. 1 Scheme of the modified measuring cell of power-compensation DSC



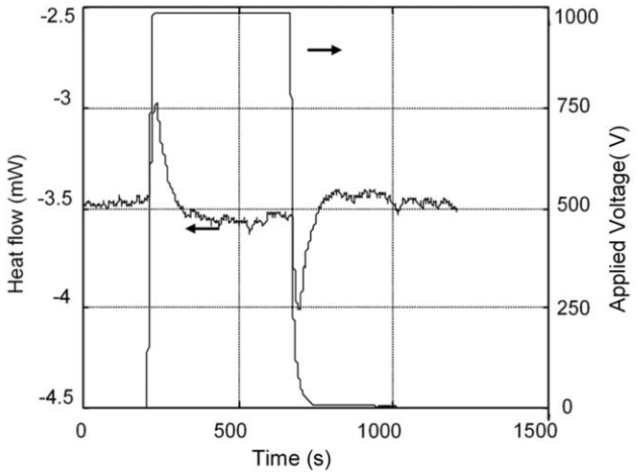
INSTITUTE OF PHYSICS PUBLISHING — JOURNAL OF PHYSICS D: APPLIED PHYSICS
J. Phys. D: Appl. Phys. **39** (2006) 4491–4496 — doi:10.1088/0022-3727/39/20/029

Ferroelectric electrocaloric conversion in $0.75(PbMg_{1/3}Nb_{2/3}O_3)$–$0.25(PbTiO_3)$ ceramics

Daniel Guyomar, Gael Sebald, Benoit Guiffard and Laurence Seveyrat

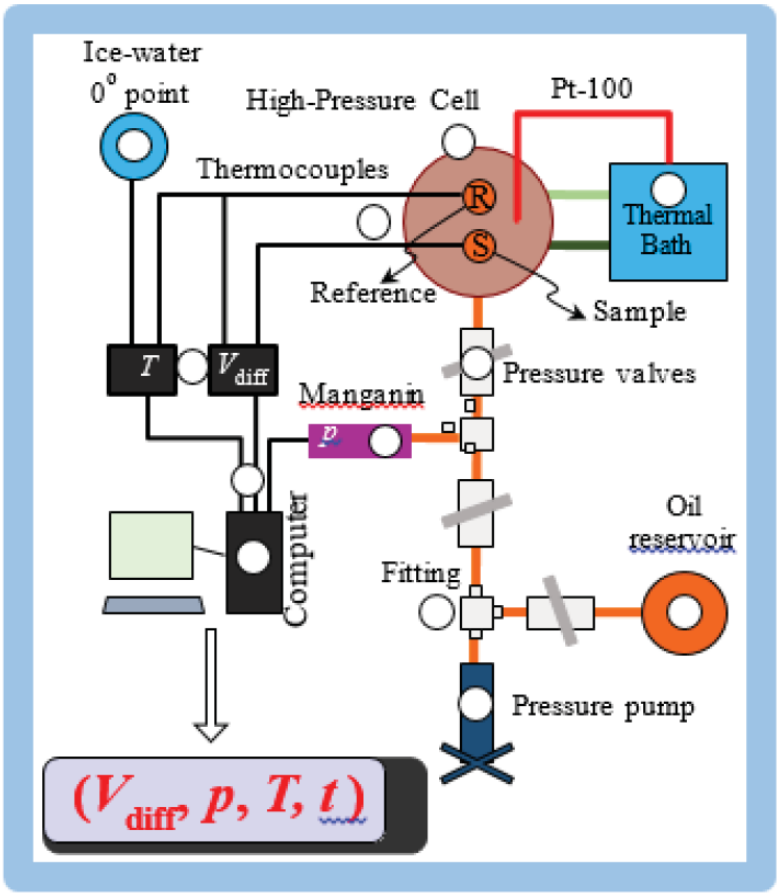
Laboratoire de Génie Electrique et de Ferroélectricité, INSA de Lyon, 8 rue de la physique, 69621 Villeurbanne cedex, France

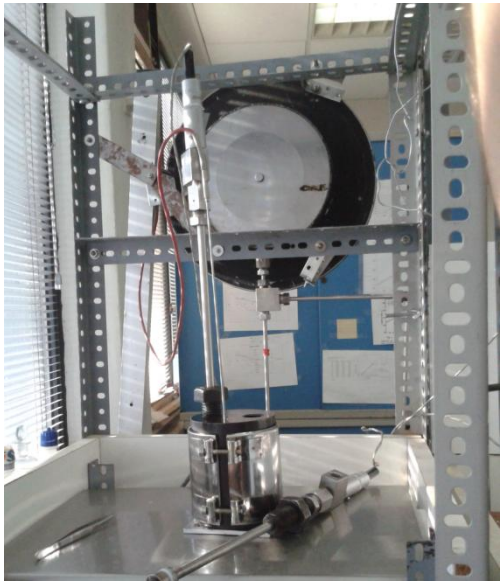
Received 16 May 2006, in final form 13 August 2006
Published 29 September 2006
Online at stacks.iop.org/JPhysD/39/4491



"DSC" (DTA) WITH HYDROSTATIC PRESSURE

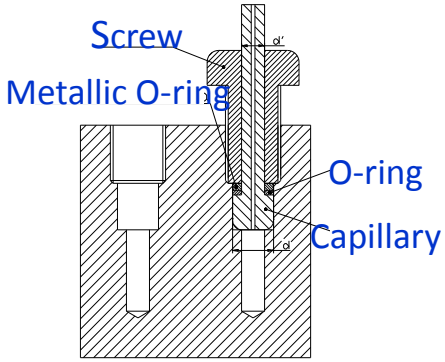
(J.L. Tamarit, Universitat Politècnica de Catalunya)

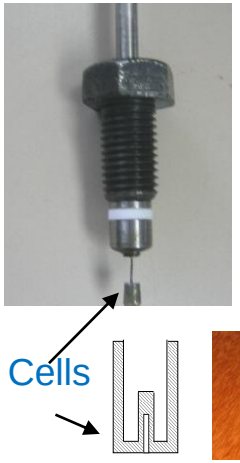




T: 100 – 500 K

p: 0 – 3kbar (0.3 GPa)



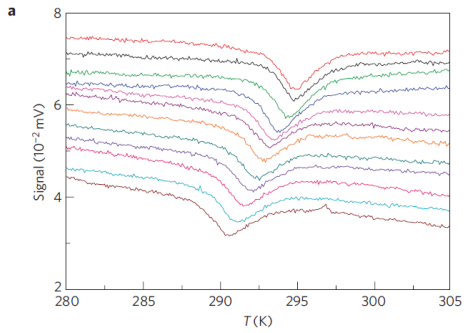


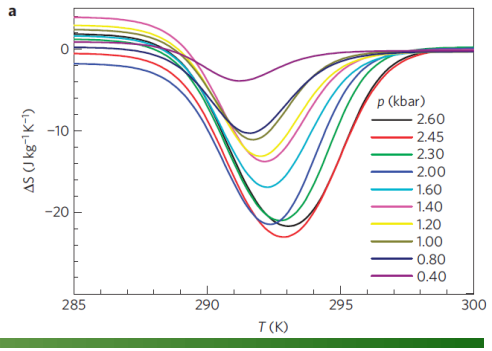
Examples

LETTERS
PUBLISHED ONLINE: 4 APRIL 2010 | DOI: 10.1038/NMAT2731
nature materials

Giant solid-state barocaloric effect in the Ni–Mn–In magnetic shape-memory alloy

Lluís Mañosa[1]*, David González-Alonso[1], Antoni Planes[1], Erell Bonnot[2], Maria Barrio[2], Josep-Lluís Tamarit[2], Seda Aksoy[3] and Mehmet Acet[3]

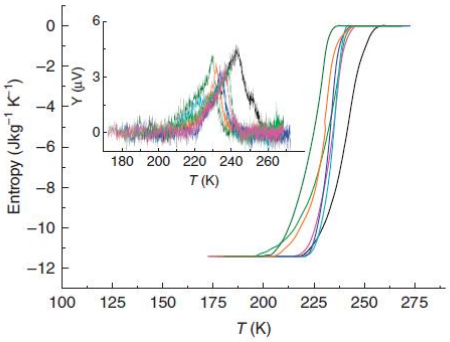


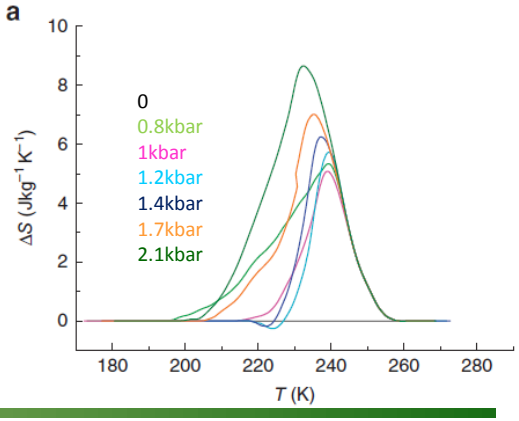


nature COMMUNICATIONS
ARTICLE
Received 20 Jul 2011 | Accepted 22 Nov 2011 | Published 20 Dec 2011
DOI: 10.1038/ncomms1606

Inverse barocaloric effect in the giant magnetocaloric La–Fe–Si–Co compound

Lluís Mañosa[1], David González-Alonso[1], Antoni Planes[1], Maria Barrio[2], Josep-Lluís Tamarit[2], Ivan S. Titov[3], Mehmet Acet[3], Amitava Bhattacharyya[4] & Subham Majumdar[4]

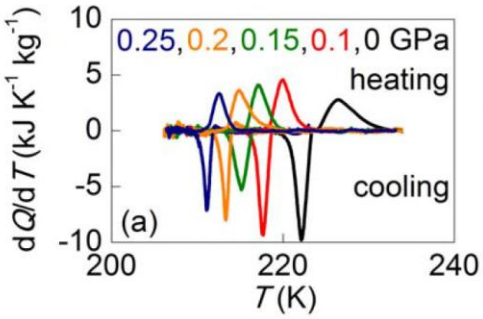


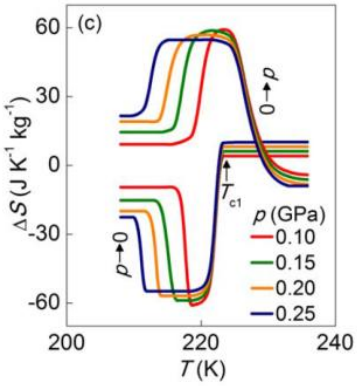


nature COMMUNICATIONS
ARTICLE
Received 17 Jul 2015 | Accepted 5 Oct 2015 | Published xx xxx 2015
DOI: 10.1038/ncomms9801 OPEN

Giant barocaloric effects at low pressure in ferrielectric ammonium sulphate

P. Lloveras[1], E. Stern-Taulats[2], M. Barrio[1], J.-Ll. Tamarit[1], S. Crossley[3], W. Li[3], V. Pomjakushin[4], A. Planes[2], Ll. Mañosa[2], N.D. Mathur[3] & X. Moya[2,3]





OTHER DTA WITH HYDROSTATIC PRESSURE

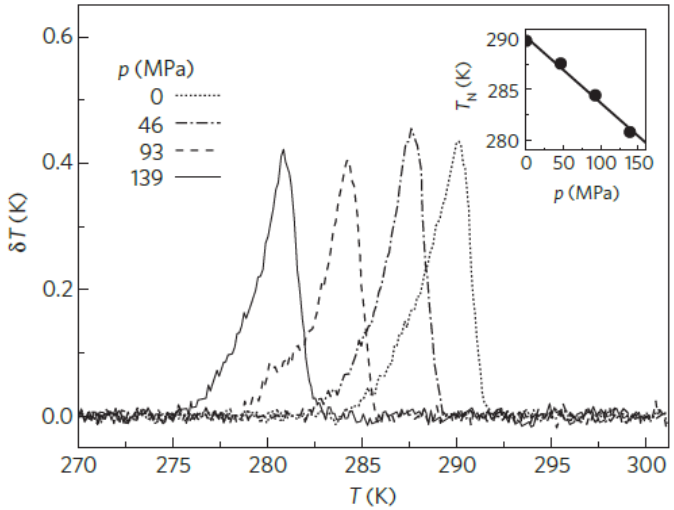
nature materials

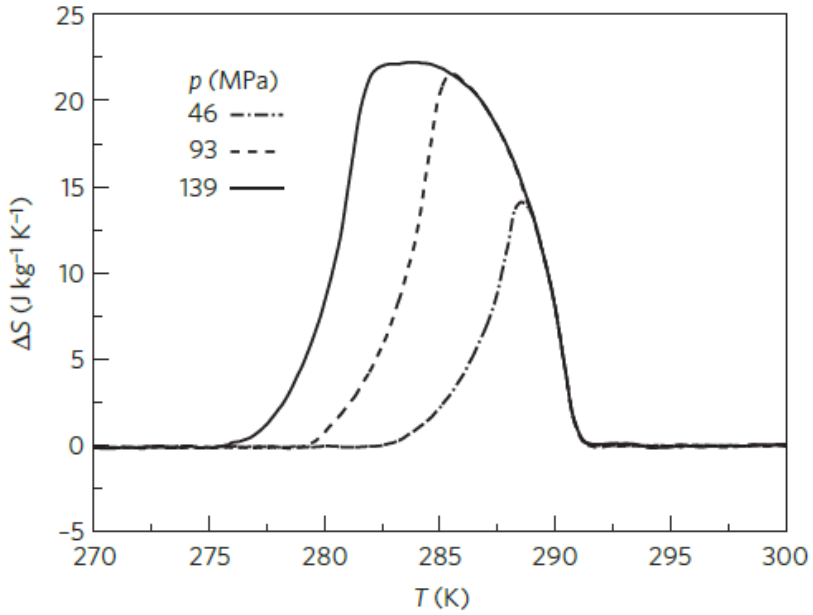
ARTICLES

PUBLISHED ONLINE: 26 OCTOBER 2014 | DOI: 10.1038/NMAT4117

Giant barocaloric effect enhanced by the frustration of the antiferromagnetic phase in Mn_3GaN

Daichi Matsunami[1]*, Asaya Fujita[2], Koshi Takenaka[3] and Mika Kano[1]





DSC WITH UNIAXIAL (TENSILE) STRESS

PHILOSOPHICAL MAGAZINE A, 1992, VOL. 65, NO. 2, 461–475

Calorimetric measurements on the $\beta \rightleftharpoons \gamma'$ and $\beta \rightleftharpoons \beta'$ martensitic transformations in a Cu–Al–Ni single crystal subjected to uniaxial tensile stress

By J. ORTÍN†, LL. MAÑOSA†, C. M. FRIEND‡,
A. PLANES† and M. YOSHIKAWA§

† Departament d'Estructura i Constituents de la Matèria, Facultat de Física,
Universitat de Barcelona,
Diagonal 647, E-08028 Barcelona, Catalonia, Spain
‡ Materials Technology Group, Cranfield Institute of Technology,
Royal Military College of Science, Shrivenham, Swindon, England
§ Institute of Scientific and Industrial Research, Osaka University,
8-1 Mihogaoka, Ibaraki, Osaka 567, Japan

[*Received 21 December 1990¶ and accepted 23 April 1991*]

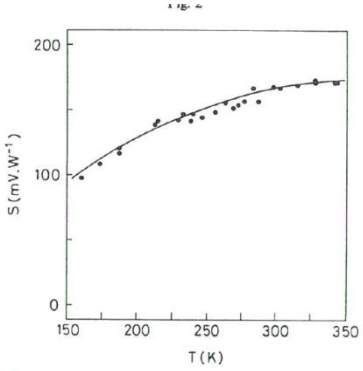


Fig. 4

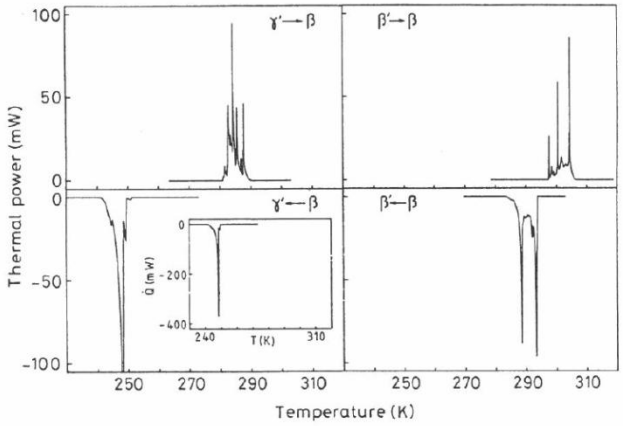
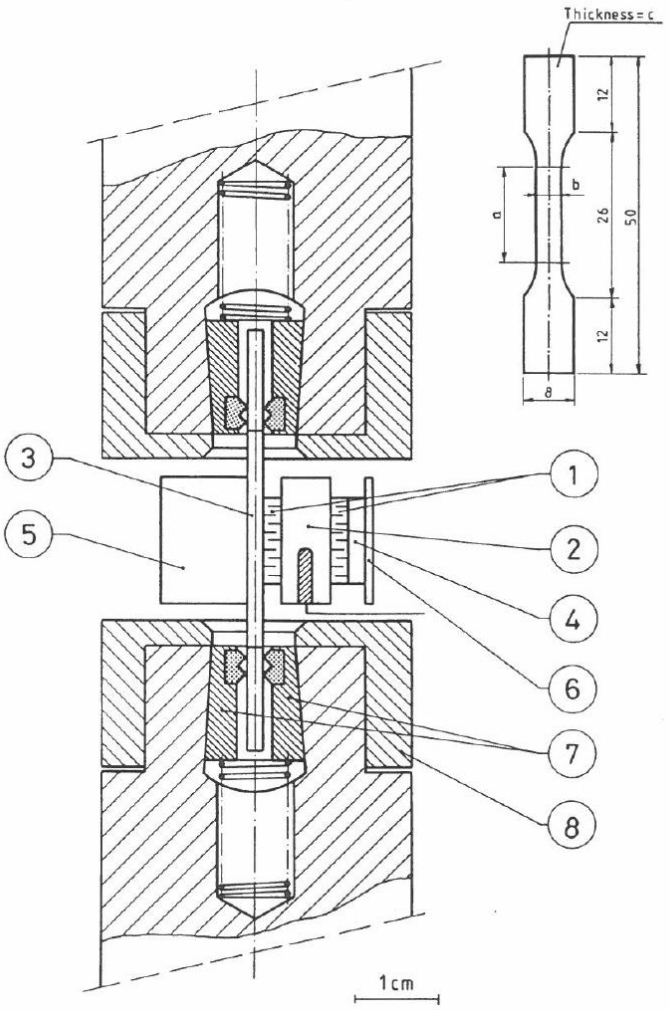
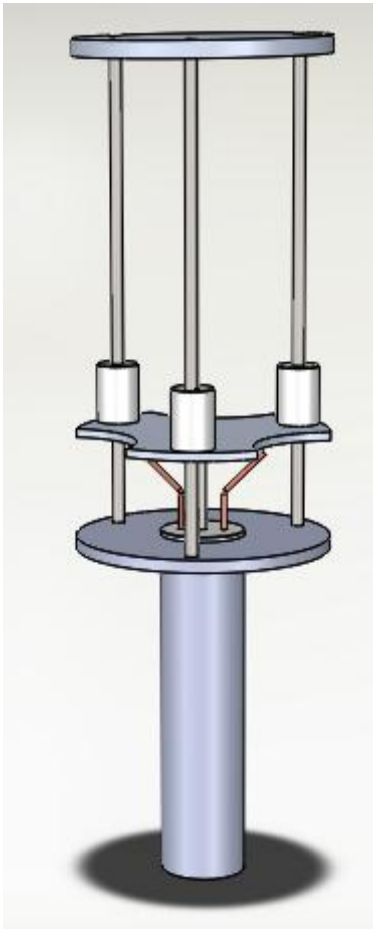
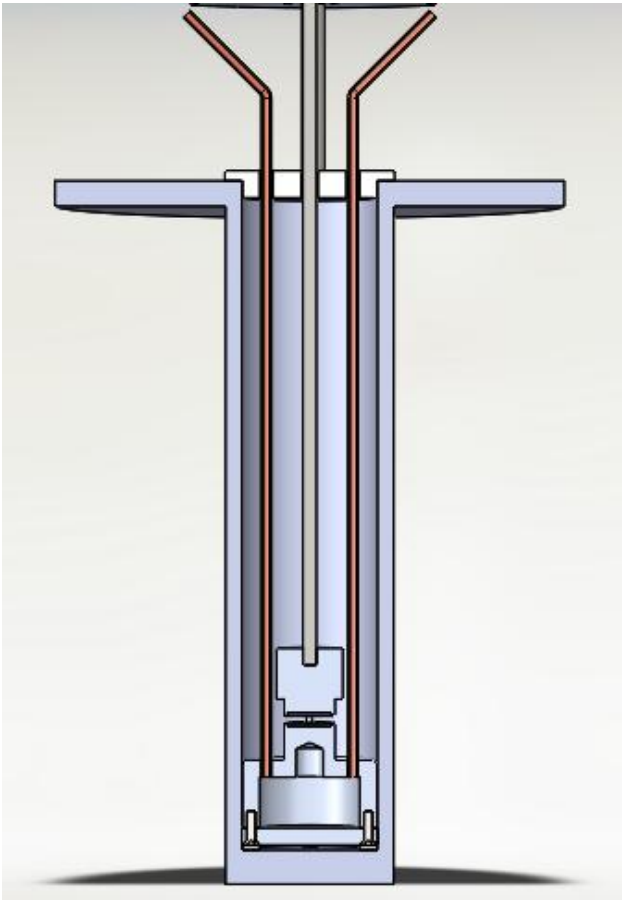


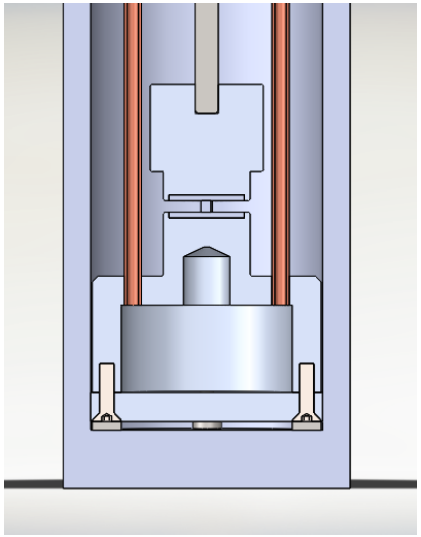
Fig.1



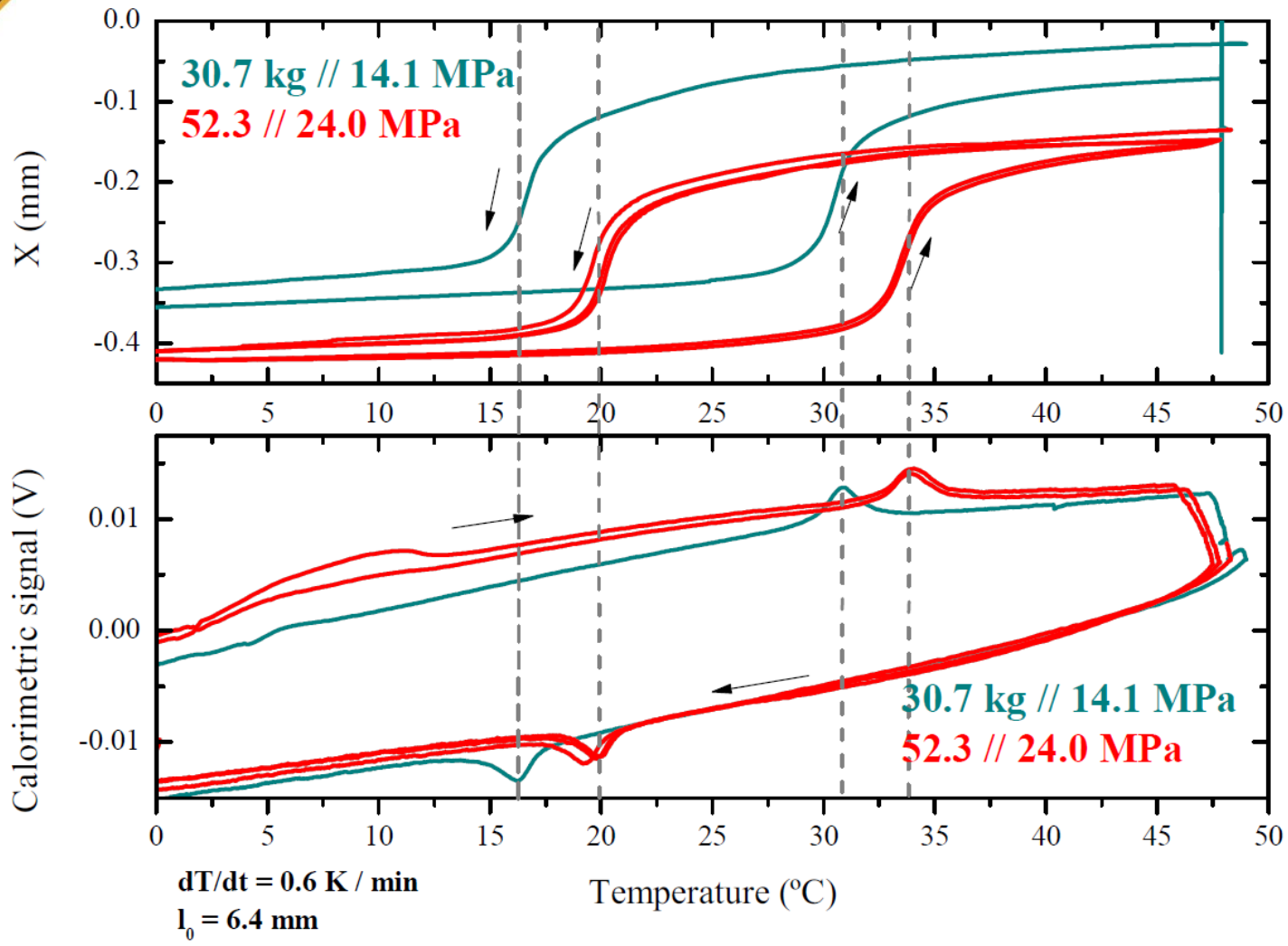
DSC WITH UNIAXIAL (COMPRESSIVE) STRESS







CuZnAl Simultaneous strain - DSC measurements



SUMMARY

DSC calorimetry under field:

Accurate determination of ΔS at caloric effects

Reproducibility of a caloric effect

.....

Future target:

DSC calorimetry under fieldS
(more than one applied field)

MULTICALORIC EFFECTS

COLLABORATORS

Enric Stern-Taulats, Rubén Millán-Solsona, Antoni Planes
Universitat de Barcelona.

Pol Lloveras, Maria Barrio, Josep-Lluís Tamarit
Universitat Politècnica de Catalunya.

THANKS FOR YOUR ATTENTION