COVER SHEET FOR GRANT PROPOSALS

State Board of Education

SBOE PROPOSAL NUMBER: (to be assigned by SBOE)	AMOUNT REQUESTED: $50,000
TITLE OF PROPOSED PROJECT: Integral 3-D Strain Sensor	
SPECIFIC PROJECT FOCUS:	

We will develop a novel 3D Strain Sensor that identifies all six strain components. Our method detects strain developed in MSMA/elastomer composite material as a change in magnetic permeability induced by deformation. Boise State University filed a patent on our technology. We work with Gryphon Business Consultants (Boise, ID) towards commercialization.

PROJECT START DATE: 7/1/13	PROJECT END DATE: 6/30/14
NAME OF INSTITUTION: Boise State University	DEPARTMENT: Office of Sponsored Programs
ADDRESS: 1910 University Dr., Boise, ID 83725	
E-MAIL ADDRESS: osp@boisestate.edu	PHONE NUMBER: (208) 426-4420

	NAME:	TITLE:	SIGNATURE:
PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR	Dr. Peter Mullner	Professor and Chair	Not required
CO-PRINCIPAL INVESTIGATOR	Dr. Nader Rafla	Associate Professor	Not required

NAME OF PARTNERING COMPANY: Gryphon Business Consultants	COMPANY REPRESENTATIVE NAME: Abid Ahmad

NAME: Abid Ahmad SIGNATURE: Abid Ahmad

Authorized Organizational Representative		
	~~Karen Henry~~ Lisa Jordan, CRA	

SUMMARY PROPOSAL BUDGET

Name of Institution: Boise State University

Name of Project Director: Dr. Peter Mullner

A. PERSONNEL COST (Faculty, Staff, Visiting Professors, Post-Doctoral Associates, Graduate/Undergraduate Students, Other)

Name/ Title	Salary/Rate of Pay	Fringe	Dollar Amount Requested
Dr. Peter Mullner, Professor and Chair	.25 months $159,037/year	30% of salary	$4,307
Dr. Nader Rafla, Associate Professor	.25 months $86,216/year	32% of salary	$3,161
Graduate Research Assistant (1); to be hired	6 months $25,000/year	7% of salary (full year rate)	$13,188
Undergraduate Research Assistant(s); to be hired	$11-$13/hr for approximately 800 hours	7% of salary (full year rate)	$9,968

% OF TOTAL BUDGET:	62%	**SUBTOTAL:**	$30,624

B. EQUIPMENT: (List each item with a cost in excess of $1000.00.)

Item/Description	Dollar Amount Requested
SUBTOTAL:	$0

G. TRAVEL:

Dates of Travel (from/to)	No. of Persons	Total Days	Transportation	Lodging	Per Diem	Dollar Amount Requested
To be determined Meetings with industry partners	2-3	2 days/ meeting	$900	$700	$400	$2,000

SUBTOTAL:	$2,000

H. Participant Support Costs:

	Dollar Amount Requested
1. Stipends	
4. Other	

SUBTOTAL:	$0

I. Other Direct Costs:	Dollar Amount Requested
1. Materials and Supplies Raw materials, parts, gas, consumables, small devices (such as a furnace and processor)	$8,000
2. Publication Costs/Page Charges	$400
3. Consultant Services (Include Travel Expenses)	
4. Computer Services	
5. Subcontracts	
6. Other (specify nature & breakdown if over $1000) Graduate Student Fee Remission estimate for academic year 2013-2014 (1 semester) Characterization Fees for the XRD/SEM (120 hours @ $35/hr)	 $4,776 $4,200
SUBTOTAL:	$17,376

J. Total Costs: (Add subtotals, sections A through I) **TOTAL:**	$50,000
K. Amount Requested: **TOTAL:**	$50,000

Project Director's Signature: Not required	Date:

INSTITUTIONAL AND OTHER SECTOR SUPPORT

(add additional pages as necessary)

A. INSTITUTIONAL / OTHER SECTOR DOLLARS

Source / Description	Amount
Supporting 50% of a graduate student stipend	$17,000
Support for the 4th International Conference on Ferromagnetic Shape Memory Alloys, ICFSMA'13, June 3-7, 2013 in Boise, ID	$11,300

B. FACULTY / STAFF POSITIONS

Description

C. CAPITAL EQUIPMENT

Description

D. FACILITIES & INSTRUMENTATION (Description)

Fully equipped laboratories (Appendix 1)

Proposal Narrative: Integral 3D Strain Sensor

1. Idaho Public Institution

Boise State University (BSU)

2. Faculty Member Leading the Project

PI: Peter Mullner, Materials Science and Engineering.

Co-PI: Nader Rafla, Electrical and Computer Engineering.

3. Previous Proposal for Incubation Fund

This technology has not previously been proposed for an Incubation Fund Award.

4. Executive Summary

Miniaturization of machines challenges classical mechanical engineering encompassing wheels, gears, and shafts which fail at small scale because of high frictional forces. Magnetic Shape Memory Alloys (MSMA) deform when actuated by a magnetic field. With MSMAs, machines operate without rotational motion. Magnetic Shape Memory (MSM) technology presents a new paradigm in engineering accessing new routes towards miniaturization in many areas of technology. Here, we will develop a novel 3D Strain Sensor that identifies all six strain components. Our method detects strain developed in MSMA/elastomer composite material as a change in magnetic permeability induced by strain. We have recently filed a patent for this concept (BSU file number 92). A local non-volatile storage and wireless transceiver will be included.

We work with Gryphon Business Consultants (Boise, ID) towards commercialization. The commercialization plan includes (i) finding an industry partner (10/2013), (ii) demonstration of

functionality (8/2014), (iii) demonstration of prototype (8/2015), (iv) integrated sensor in pilot device (8/2016), (v) develop license agreement, and (vi) production (8/2017).

5. "Gap" Project Objective and Total Amount Requested

The objectives of this project are

a. To develop a MSMA/elastomer composite transducer material.

b. To develop a drive/detect coil system with control electronics.

c. To demonstrate the 3D sensor functions.

Total mount requested towards objectives a) through c): $50,000.

Objectives a) through c) are milestones preparing for the second part of this project to be conducted in the following year, additional funds will be requested for the subsequent year

d. To build and test a prototype 3D Strain Sensor.

6. Description of Resources Committed; Compare To the BSU Priorities

Boise State University lists five research strengths/priorities (http://research.boisestate.edu/areas-of-research-strength-at-boise-state-university/) including (1) Novel Materials, (2) Sensor Development, (3) Nanoelectronics and integrated systems, (4) Geochemistry and Geophysics, and (5) Health, public and energy policy. The proposed project advances novel materials, develops a sensor, and builds an integrated system. Thus, this project supports three of the five institutional emphases.

7. Evidence for Potential Impact on the Economy of Idaho

During the past nine years, close to forty (40) undergraduate and graduate students have worked in the Magnetic Materials Laboratory with Dr. Müllner and received in-depth training on Magnetic Shape Memory Alloys. About twenty five of these have graduated. Many Materials

Science and Engineering graduates prefer employment in the Treasure Valley over other places in the US and stay in the region.

With such a large number of experienced students and graduates, the Treasure Valley presents one of the largest – if not the largest - concentration of MSMA expertise worldwide. Boise is thus the right place to start a business on MSMA technology.

Dr. Müllner collaborates with many international, leading scientists in the field in countries such as Germany, England, Spain, Italy, Switzerland, Austria, China, and Japan. With these contacts, he can ensure sustaining new developments with cutting edge know-how. Dr. Müllner and Dr. Knowlton organize the 4th International Conference on Ferromagnetic Shape Memory Alloys (ICFSMA'13) in Boise, ID, June 3-7, 2013. Bringing this conference to Boise (previous host countries include India, Spain, and Germany) demonstrates the recognition of Boise State University as a leading institution in the field.

This project will attract venture capitalists to invest in the Treasure Valley. This is the first technology project initiating a series of further technology development efforts including an MSM based pump for micro-fluidics applications (lab-on-the-chip, insulin pump), four-state memory and more. Thus, this project will initiate a new industry located in Idaho.

Tires for earth moving equipment led themselves as market entry for developing technology in Idaho. The Intermountain West is home to several large and medium mining companies and failure of tires present a major cost and risk to human life and equipment. Mine operators and equipment vendors seek a solution to premature tire failure.

8. Market Opportunity

a. ***Need addressed by the project:*** The performance and lifetime of elastic materials (e.g. in tires, seats, cloths, shoes, floors, buildings) depends on variable loading conditions, wear, and

other extrinsic factors. Failure of elastic materials causes large material and health damage and often fatalities. Preventing damage, accurately predicting the end of useful life, and increasing user health (e.g. car seats, workplace furniture) requires automated surveillance of the elastic behavior of the material. The elastic behavior is described with the 3D strain tensor comprising six independent strain components. Accurate characterization of the performance requires the simultaneous measurement of all six strain components.

Presently, there is no device on the market with the capacity to measure more than one strain component. Furthermore, existing technology measures strain externally. Our technology measures all six strain components and is embedded internally as an integral part of the material.

b. ***Applications and markets for the technology:*** The technology will enter a multi-billion dollar market in the car industry. For example as in-cushion sensors to increase driver and passenger comfort, as impact and tire sensors to accurately predict the remaining useful life. Other markets include the health sector, office furniture, haptics technology (surgery, defense, remote control of complex systems).

c. ***Product, market audience, competition, and barriers to market entry:*** The product is an Integral 3D Strain Sensor. The target audience (market audience) include car owners, operators of earth moving businesses such as open pit mines, tire manufacturers, developers of airplane wheals etc. There is no competition with regard to a similar device measuring the 3D strain state. Where solutions exist, these are of partial nature and are based on external 1D sensors.

The novelty of the MSM technology presents a barrier to the market. To overcome this barrier, we selected the surveillance of tires of large earth-moving equipment as market entry. The industry has currently no solution for predicting tire failure. Tire failure often causes large

damage in form of equipment down time and collateral damage. A single tire costs in the order of $100,000. Thus, high investment costs motivate the industry to explore novel solutions.

9. Technology and Path to Commercialization

Technology and current state of technology: MSMAs are multi-functional materials with strong coupling between magnetic and structural order which leads to a very large magnetic-field-induced strain (MFIS). The MSM effect arises through the magnetic-field-induced motion of twin boundaries. Compared to other technologies MSM actuators offer several benefits: (1) up to 100 times longer stroke than piezo materials, (2) fast response, (3) large work output, (4) high position accuracy, (5) high dynamic range, (6) low power consumption, and (7) simple and reliable. These advantages lead to a new paradigm in mechanical engineering at small scale.

1D Strain Detector

A schematic of the 1D detector (Fig. 1a-c) consists of a MSM element as transducer (1), a drive coil (2), a pick-up coil (3), and an elastomer (not shown), in which the MSM element and the coils are embedded. The drive coil provides an AC signal. Upon compression, the inductance increases due to an increase of the permeability. We demonstrated the concept with a hand-made device with only one coil serving as drive-coil and pick-up coil (Fig. 1b).

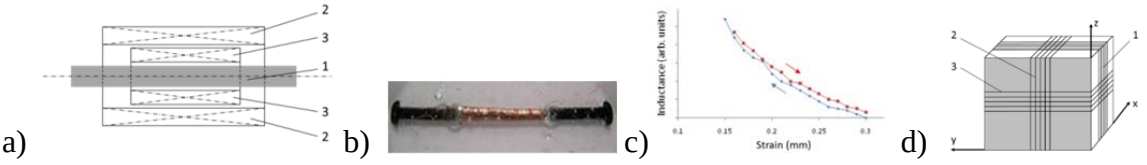

Figure 2: MSMA-based sensor; a) schematic of the 1D sensor; (b) proof-of-concept 1D senor; the length of the coil is about 1 cm; (c) preliminary results showing a strong effect of the deformation of the MSM element on the inductance of the coil; (d) schematic of the 3D sensor.

3D Strain Detector

A schematic of the 3D detector consists of an elastomer-MSM composite as transducer (cube in Fig. 1d), three sets of coils (1,2,3) and an elastomer casing. The functionality is the same as for

the 1D sensor, except that here the inductance can be measured in three directions, i.e. coil sets 1, 2, and 3 provide the normal strains in *x*, *y*, and *z* direction.

The transducer is a composite of a MSMA in form of particles embedded in an elastomer matrix. MSMA particles must be single crystalline. The elastomer is chosen with stiffness large enough to control the deformation in the MSMA element; it needs to be higher than the stiffness of the MSMA component. MSMA deforms under a very small stress between 0.1 and 1 MPa. Hence, the stiffness at full elongation is 0.0016 to 0.016 GPa. The Young modulus of rubber is typically between 0.01 and 0.1 GPa allowing for selecting an optimal matrix material.

a. ***How the technology contributes to the product and market need and its intellectual property status:*** The invented sensors can measure externally applied forces in three dimensions, using stress-strain relationships. These sensors are small (less than $1cm^3$) and could be used in many research fields and industry applications. For example, one of the promising applications in automobile industry is to monitor the wear conditions of tires to accurately predict the remaining life. Predicting remaining tire life is particularly important for large vehicles such as trucks and earth moving equipment, where a single tire failure causes damage of hundreds of thousands of dollars at the earth moving equipment and millions of dollars in collateral damage.

b. ***Who developed the technology and with what funding:*** The technology was developed by Dr. Müllner, Dr. Kari Ullakko, and Kotaro Sasaki, at the time of invention all employed at BSU. The invention was demonstrated using university funds.

c. ***Concrete steps to bring technology to market: already undertaken***

DATE	ACTION
May 4, 2011	Conceived invention
June 2011	Demonstrated proof of concept
July 7, 2011	Disclosed invention to Boise State University's Office of University and Industry Venture

October 2011	Filed provisional patent
September 24, 2012	Contacted Gryphon Business Consultants
October 15, 2012	Filed utility patent
Fall 2012	Worked with five teams of MBA 531 (Instructor C. Sucio) October-November 2012. The teams explored markets for this (and other) BSU IP on MSM technology
January 11, 2013	Decided to work with Gryphon Business Consultants towards transferring MSM technology and worked with potential corporate partners to identify development/marketing opportunities.

Future steps towards bringing the technology to market include:

DATE	ACTION
June 2013	Perform a business development event (BDE) on June 5, 2013 as part of the 4th International Conference on Ferromagnetic Shape Memory Alloys (ICFSMA'13, http://www.icfsma.com/) June 3-7, 2013 in Boise, ID
October 2013	Identify industry partner by October 2013
August 2014	Demonstrate 3D sensor functions
August 2015	Build prototype for the Integrated 3D Strain Sensor
August 2016	Integrate sensor in pilot device (tire)
October 2016	Develop license agreement with industry partner
August 2017	In production by August 2017

Interested industrial partners include regional mines such as Barrick Gold in Elko, NV and Baker Hughes Barite Mine in Battle Mountain, tire companies such as Goodyear.

10. Commercialization Partners

We collaborate with Gryphon Business Consultants (GBC) who specializes on new business development. GBC has more than 20 years industrial experience in developing technology. The commercialization plan includes

a. ***Securing technology development funds:*** We have secured 50% of a graduate student stipend and laboratory facilities. With this proposal, we request additional 50% of a graduate student, support for an undergraduate student, material, and other expenses.

b. ***Developing prototype:*** We have demonstrated prove of concept for a 1D sensor and submitted a patent on this invention. With this proposal, we will demonstrate the sensing functions of a 3D sensor. We will build the complete sensor prototype in project phase 2.

c. ***Identifying industrial partner:*** We have partnered with GBC. June 5, 2013, we organize a Business Development Event as part of the 4th International Conference on Ferromagnetic Shape Memory Alloys, ICFSMA'13, in Boise, ID, June 3-7, 2013 (http://www.icfsma.com/).

d. ***Securing production development funds***

e. ***Developing production***

f. ***Production***

11. Specific Project Plan and Detailed Use of Funds

Project Plan for Year 1

We will develop the composite transducer material, the coil sets and control electronics, and demonstrate 3D strain sensor functions.

a. ***Development of a MSMA/elastomer composite transducer material:*** The transducer material is a composite of an MSMA in form of particles embedded in an elastomer matrix. Particles will be produced from the elements by melting, casting, and grinding. The powders will be characterized with XRD regarding structure and magnetic properties. Individual powder particles will be characterized regarding single crystallinity, magnetic properties, twinning stress, and switching field. The criterion for further use is low switching field of less than 300 mT.

The elastomer will be chosen with stiffness large enough to control the deformation in the MSMA element; it needs to be higher than the "pseudo-stiffness" of the MSMA component (see section 9a). Powder/elastomer composites will be made where the volume fraction of particles and particle size will be systematically varied. Criteria for further use in 3D sensors are (i)

deformation-induced twinning and (ii) reversal of twinning upon unloading. If the fraction of particles is too small, the elastomer deforms around the particles without transferring the strain to the MSMA particles. If the fraction of particles is too large, the restoring force of the elastomer on the deformed particles is too weak and does not reverse the deformation. Thus, there is an optimal fraction of particles which satisfies both criteria. Deformation experiments will be performed with an existing Zwick 1445 mechanical testing machine. Finally, 3D drive and sensor coils will be fabricated and tested.

b. ***Development of a drive/detect coil system with control electronics:*** Powering the sensor requires the use of a battery or an energy harvesting technique. Two 675-size zinc-air cells supply sufficient energy to operate the sensor continuously for a reasonable amount of time. These cells are of a small size, readily available, reliable, very inexpensive, and offer higher volumetric and mass energy density than all other commonly available cell types. A viable alternative to using batteries is "Energy Harvesting." These techniques allow energy captured from the surrounding environment such as radio waves, waste heat, and kinetic energy from movement to be converted into electrical energy sufficient to operate the proposed system. We will investigate the usage of these techniques and their circuit design for inclusion in the sensor.

The heart of the system is a microprocessor/microcontroller. It allows receiving measurement data from the sensor coils, applies algorithms to detect all six strain components, and provides the ability to communicate the occurrence of events to an external monitoring system via a wireless connection. Varity of these are available in the market and range from processors targeting signal processing to general purpose microcontrollers. For example, the Ultra-low power processor, available from NXP Semiconductor Inc., is a good candidate for use with the proposed sensor.

c. ***Demonstration the 3D sensor functions*** at the end of the first project year.

Project Plan for Year 2

In 2014, we will apply for a second project to build and test a prototype 3D Strain Sensor.

Detailed Use of Funds for Year 1

ITEM	FUNDS ($)
Salaries (1/4 month for PI and co-PI, ½ stipend for graduate student, undergraduate student	30,600
Materials and supply (raw materials, parts, small devices such as a furnace, processor, gas, consumables)	8,000
Fees for materials characterization (120 hours XRD/SEM at $35.00 per hour)	4,200
Travel for meetings with industry partners	2,000
Publication costs	400
Student costs (1/2 tuition)	4,800
Total	**50,000**

12. Institutional and Other Sector Support

Boise State University's commitments towards this project include:

a. Fully equipped laboratories (Appendix 1).

b. Filing a patent "Sensor Device" in October 2012.

c. Supporting 50% of a graduate student stipend with $17,000 per year (including tuition and benefits, resources of Department of Materials Science and Engineering).

d. Hired a PhD student to this project starting in June 2013.

e. An undergraduate student who is familiar with the sensor is available to start in fall 2013.

f. Exploring the potential market through the MBA-executive program (Fall 2012).

g. Support for the 4th International Conference on Ferromagnetic Shape Memory Alloys, ICFSMA'13, June 3-7, 2013 in Boise, ID with $11,300.

FACILITIES AND EQUIPMENT

Most of the equipment is available in the 1600 square foot Magnetic Materials Laboratory of the PI, the Boise State Center for Materials Characterization (BSCMC, located in the College of Engineering http://coen.boisestate.edu/bscmc/index.htm), the Idaho Mircrofabrication Laboratory (IML, located in the College of Engineering http://coen.boisestate.edu/IMFL/index.html).

The instruments at BSU include

- Sputter deposition system with co-sputter (2 targets) and reactive sputter capability.
- Two AFM (Veeco Dimension 3100 Atomic Force Microscopy System and Veeco PicoForce Multimode Atomic Force Microscopy System) with dedicated software for analyzing phase, amplitude and height and MFM and nanoindenter functions. The system also includes harmonics imaging and in-situ heating-cooling capabilities.
- Scanning electron microscope -- LEO 1430VP with energy-dispersive X-ray spectroscopy (EDS) capability, electron beam lithography (EBL), electron backscatter diffraction (EBSD).
- Transmission electron microscope JEOL 2100 LaB_6, with scanning transmission electron microscopy capabilities, EDS, EELS, and magnetic domain imaging.
- x-Ray diffractometer Bruker D8 Discover with variable temperature up to 1600ºC, texture capabilities, thin film reflectometry, phase analysis, and HiStar area and scintillation detectors.

- Optical microscope -- Zeiss Axiovert 200 MAT with CCD camera and software.
- Optical microscope – MEIJI MT7100 with OPTIXCAM camera.
- High-resolution optical camera INFINITY with 21 megapixel resolution and video capability.
- High-sensitive Vibrating Sample Magnetometer (VSM) -- ADE model 10 with maximum field 2 T and heating/cooling capabilities for the temperature range from -100°C to 150°C.
- Variable temperature probe station for electrical measurements between 5.5 K and 450 K.
- Advanced electrical characterization systems (attoampere and microvolt resolution) -- Keithley 4200 Semiconductor Characterization System Keithley 595 Quasistatic Capacitance-Voltage Meter, HP 4284A LCR meter, Keithley 707A Ultra Low Current-High Frequency Solid State Switching Matrix (2-8X24 I/O cards), Agilent 81110A Pulse/Pattern Generator Unit (2 channels - frequency range up to 330MHz), Agilent Infiniium 54832D 1GHz 4 channel 4GSamples/s Mixed Signal Oscilloscope.
- Multibeam optical system of k-Space for substrate curvature measurements for temperatures up to 1,100°C. Separate temperature reading system "BandiT" for temperature reading up to 600°C.
- 1A power supply, platinized titanium anodes, beakers, hot plate, exhaust hood used for electrochemical deposition of thin films on conductive substrates.
- High-precision wire saw.

- Induret casting furnace for the fabrication of sputter targets and ingots.
- Pumping system to evacuate samples in a quartz glass tube and to flush the tube with inert gas such as argon.
- Tube furnaces.
- Beowulf-Cluster (130-processor Beowulf parallel computer-cluster user facility at BSU).
- Software: Mathematica, LabView, Modelsim & Cadence.
- Function / Arbitrary Waveform Generator, (HP_Agillent 33250) offers a full set of functions and waveforms with 12 bit resolution and a 200 MS/s sampling rate.
- Agilent MSO7034B Mixed Signal Oscilloscope. 350 MHZ with 4 analog plus 16 digital channels, 8 Mpts responsive deep memory, and 2 GSa/s sample rate
- Agillent E3631A 80W triple output: 0 to 6 V and 0 to ± 25V

- The facilities of the PI further include a 400 square foot student office with 7 desk spaces and 6 computers with internet access.

Peter Müllner

Professional Preparation

ETH Zürich, Swiss Fed. Inst. of Tech., Zürich, Mater. Eng., Diploma (M.S.), 1991
ETH Zürich, Swiss Fed. Inst. of Tech., Zürich, Mater. Eng., Dr. sc. techn. (Ph.D.), 1994

Appointments

2013-pres. Chair, Materials Science and Engineering, *Boise State University*, Boise, ID
2012 Visiting Professor, Physics, *University of Vienna*, Austria
2012-pres. Distinguished Professor, *Boise State University*, Boise, ID
2011-pres. Foundational Studies Program Faculty, *Boise State University*, Boise, ID
2009-pres. Professor, Mater. Sci. & Eng., *Boise State University*, Boise, ID
2006-2011 Director, Boise State Center for Mater. Charact., *Boise State University*, Boise, ID
2004-2009 Associate Professor, Mater. Sci. & Eng., *Boise State University*, Boise, ID
1998-2004 Senior Researcher**,** *ETH Zürich, Inst. of Appl. Phys.*, Zürich, Switzerland
1996-1998 Research Associate**,** *Max-Planck-Inst. fur Metallforsch.*, Stuttgart, Germany
1995 Post-doctoral Researcher**,** *University of Illinois*, Urbana, IL
1991-1994 Research Assistant**,** *ETH Zürich, Inst. of Appl. Phys.*, Zürich, Switzerland
1991-1994 Teaching Assistant**,** *ETH Zürich, Inst. of Appl. Phys.*, Zürich, Switzerland
1990 Research Internship**,** *Alusuisse-Lonza Services AG*, Neuhausen, Switzerland
1988 Research Internship**,** *Contraves AG*, Zürich, Switzerland
1987-1988 Teaching Assistant**,** *ETH Zürich, Dept. of Materials*, Zürich, Switzerland

Publications: 112 published articles, 4 patents granted, 4 patents pending

Selected publications (closely related to proposal)

1) D. C. Dunand and P. Müllner, "*Size effects on magnetic actuation in Ni-Mn-Ga shape-memory alloys*", Advanced Materials, **23** 216-232 (2011).
2) P. Müllner, V.A. Chernenko, G. Kostorz, "*Stress-induced twin rearrangement resulting in change of magnetization in a Ni-Mn-Ga ferromagnetic martensite*", Scripta Mater., **49** 129-133 (2003).
3) Y. Boonyongmaneerat, M. Chmielus, D. C. Dunand, P. Müllner, "*Increasing magnetoplasticity in polycrystalline Ni-Mn-Ga by reducing internal constraints through porosity*", PRL **99** 247201 (2007)..
4) M. Reinhold*, D. Kiener, W. B. Knowlton, G. Dehm, and P. Müllner, "*Deformation twinning in Ni-Mn-Ga micropillars with 10M martensite*", Journal of Applied Physics **106** 053906 (2009).
5) M. Chmielus, X. X. Zhang, C. Witherspoon, D. C. Dunand, and P. Müllner, "*Giant magnetic-field-induced strains in polycrystalline Ni-Mn-Ga foams*", Nature Materials **8** 863-866 (2009).

Selected publications (others)

6) K. Ullakko, L. Wendell, A. Smith, P. Mullner, G. Hampikian, "*A magnetic shape memory micropump: contact-free, and compatible with PCR and human DNA profiling*", Smart Mater. Struct. **21** 115020 (2012).
7) P. Müllner and A. H. King, "*Deformation of hierarchically twinned martensite*", Acta Materialia 58 5242-5261 (2010).

8) U. Gaitzsch, J. Drache*, K. McDonald*, P. Müllner, P. Lindquist "*Electrochem. Deposition of Ni_2MnGa Martensitic Alloy*", Proc. Int. Conf. ICFSMA'11, Dresden, Germany, July 18-22, 2011, pp. 143-144.
9) M. Reinhold*, W. B. Knowlton, P. Müllner, "*Characterizating twin structure and magnetic domain structure of Ni-Mn-Ga through atomic force microscopy*", Proc. Int. Conf. 'ICOMAT'08', Santa Fe, NM, June 29-July5, 2008, (2009) 299-304.
10) P. Müllner, V.A. Chernenko, M. Wollgarten, G. Kostorz, "*Large cyclic deformation of a Ni-Mn-Ga shape memory alloy induced by magnetic fields*", J. of Applied Physics, **92** (11) 6708-6713 (2002).

Synergistic Activities

- Foundational Studies Program Faculty since 2011; developing a university foundations UF100 course for all incoming students; the course is entitled "Invention and Discovery in History and Society".
- Director of the Boise State Center for Materials Characterization since 2006-2011.
- Organization and instruction of tutorials and teaching workshops including "Magnetic Shape Memory Alloys" at the MRS Fall Meeting 2009, Boston, MA; and the advanced training course 'Materials Science of Thin Films' of the German Society of Materials, Stuttgart, Germany, March 9-11, 1998.
- Co-organizer of international symposia/workshops including the ICFSMA'13 conference, June 3-7 2013, Boise ID; MRS Spring Symposium Z "Materials Structures – The Nabarro Legacy", San Francisco, March 25; 2008 and Guest Editor for *Progress in Materials Science*, Vol. 54, Issue 6, Elsevier August 2009 Special Issue "The Nabarro Legacy – Perspectives for advanced materials in the 21st century". Furthermore co-organizer of the international workshop 'Magnetic Shape Memory Alloys', Ascona, Switzerland, September 11-16. 2005.
- Guest lectures at the Royal Institute of Technology, Stockholm, Sweden, February 2008; Guest lectures at the University of the Basque Country, Bilbao, Spain, July 2010.

Current Support

- National Science Foundation: Materials World Network: Deformation via the Transformation of Hierarchical Microstructures, $480,000.
- National Science Foundation: International Conference on Ferromagnetic Shape Memory Alloys 2013, $5,000.
- National Science Foundation: Mechanics of Magnetic Shape-Memory Alloy Nanostructures, $400,000.
- National Science Foundation: MRI: Acquisition of a GPU-accelerated High Performance Computing and Visualization Cluster, $555,384.
- National Science Foundation: Collaborative Research: Size Effects on Magneto-mechanics of Ni-Mn-Ga Fibers, $346,345.
- Department of Energy: Fracture Mechanisms and Fatigue of Magnetic Shape-Memory Alloys. $456,000.

Nader I. Rafla

PROFESSIONAL PREPARATION:

Helwan University, Cairo, Egypt,	BSEE,	1978
Case Western Reserve University, Cleveland, Ohio	MSEE,	1982
Case Western Reserve University, Cleveland, Ohio	Ph.D.,	1991

APPOINTMENTS:

2011 – Present	Associate Professor and Graduate Coordinator for Computer Engineering Electrical and Computer Engineering Department, Boise State University, Boise, Idaho
2010 – 2011	Chair, Electrical and Computer Engineering Department, Boise State University, Boise, Idaho
1997 – 2010	Associate Professor, Electrical and Computer Engineering Department, Boise State University, Boise, Idaho
1991 – 1997	Assistant, Associate Professor, Manufacturing Engineering Department, Central State University, Wilberforce, Ohio

OTHER RELATED APPOINTMENTS:

Summer 2011 General Chair, 55th IEEE International Midwest Symposium on Circuits and Systems (MWSCAS2012), Boise ID. **Duties**: manage all arrangements for hosting the symposium along will all its technical aspects

Summers 2002 – 2007 R&D Scientist and Consultant, ASCI, Inc., Boise ID. **Duties:** Manage a team of engineers, graduate, and undergraduate students to develop Intellectual Property (IP) Hardware using HDL for different aspects of digital image caption, generation, transmission, and display

MOST RELEVENT PUBLICATIONS

1. Nader Rafla and Nick Pauly, " An Automated embedded system for Object Measurement," *Proceedings of the International Midwest Symposium on Circuits and Systems, 8/2012*
2. Rafla, Nader I., "Teaching Digital Systems Verification Methodologies Using SystemVerilog," *118th ASEE Annual Conference and Exposition, Vancouver, BC, Canada,* 6/2011
3. Nader Rafla, and Sarath Giri, *"A Programmable Pattern Generator for Memory Testing on a Programmable Chip,"* Submitted to the IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, February 2010
4. Nader I. Rafla and Steve Bard, "Reducing Power Consumption in FPGAs by Pipelining," Proceedings of the 51st IEEE International Midwest Symposium on Circuits and Systems (MWSCAS), Knoxville, TN, 8/2008
5. Nader I. Rafla, *"Real-time 3D Image Visualization System for Digital Video on a Single Chip,"* The IEEE International Symposium on Signal Processing and Information Technology (ISSPIT) Athens, Greece, December 2005

Other Related Publications

1. Rafla, Nader and Gauba, Deepak, "Hardware Implementation of Context Switching for Hard Real-Time Operating Systems," *Proceedings of the 54th IEEE International Midwest Symposium on Circuits and Systems, 8/2011*

2. Rafla, Nader I., "Teaching Digital Systems Verification Methodologies Using SystemVerilog," *118th ASEE Annual Conference and Exposition, Vancouver, BC, Canada*, 6/2011
3. Wald, Steve; Baker, R. Jacob; Mitkova, Maria I.; and Rafla, Nader I., "A Non-Volatile Memory Array Based on Nano-Ionic Conductive Bridge Memristors," *IEEE Workshop on Microelectronics and Electron Devices (WMED), Piscataway, NJ 4/2011*
4. Nader Rafla and Indrawati Gauba, *"A Reconfigurable Pattern Matching Hardware Implementation using On-Chip RAM-Based FSM,"* The IEEE International Midwest Symposium on Circuits and Systems (MWSCAS), Seattle, Washington August 2010
5. Fan Xiong and Nader Rafla *"On-Chip Intrinsic Evolvable Hardware Methodology for Sequential Logic Circuit Design"* The IEEE International Midwest Symposium on Circuits and Systems (MWSCAS), Cancun, Mexico, August 2009.
6. Nader I. Rafla, *"Evolvable Reconfigurable Hardware Framework Edge Detection,"* The IEEE International Midwest Symposium on Circuits and Systems, Montréal, Quebec, August 2007.
7. Nader I Rafla and Brett L. Davis *"A Study of Finite State Machine Coding Styles for Implementation in FPGAs,"* The IEEE International Midwest Symposium on Circuits and Systems (MWSCAS), San Juan, Puerto Rico, August 2006
8. Parke, Stephen; Dutagupta, Sid; Burkett, Susan, Rafla, Nader, "*New Microelectronics Program at Boise State University: The Idaho Microelectronics Manufacturing Research Center*" Proceedings of the 1997 12th Biennial University/Government/Industry Microelectronics, sponsored by IEEE, Rochester, NY, Jul 20-23 1997

Currently FUNDED GRANTS, PROJECTS & CONTRACTs

No current support

SYNERGISTIC ACTIVITIES

- Participated in grant proposal review for NSF/CCLI Proposals - 2009;
- Active member of the Steering Committee of the IEEE/MWSCAS conference since 2005. Will be the General Chair of the conference for 2012 in Boise, Idaho;
- College of Engineering elected representative to the Faculty Senate, Boise State Univ. since 2006
- Member of the graduate Council at Boise State University since 2007;
- Technical Reviewer for IEEE Transaction on Computers, Image Processing, Parallel & Distributed Systems;
- Reviewer, ASEE Computers in Education Journal and the ASEE general conference;
- Member of the American Society for Engineering Education (ASEE);
- Senior Member of the Institute of Electrical and Electronic Engineering (IEEE), computer society, and Circuits and Systems Society;
- Recipient of several teaching rewards;
- Currently supervising 2 Ph.D. Dissertations, 5 MSEE Thesis advisor, and on Graduate Thesis Committee for 3 students.

RECENT COLLABORATORS:

Maria Mitkova, Elisa Barney Smith, Said Ahmed-Zaid, and Tim Andersen at Boise State University; Maher Rizkalla at Indiana University Purdue University (IUPUI) at Indianapolis; William Grissom, Abayomi A. Majebi, and Augustus Morris at Central State University, Wilberfrce, Ohio; Steven Parke at Tennessee Tech. University; Suzann Burkett at University of Alabama.

Peter Müllner

Professional Preparation

ETH Zürich, Swiss Fed. Inst. of Tech., Zürich, Mater. Eng., Diploma (M.S.), 1991
ETH Zürich, Swiss Fed. Inst. of Tech., Zürich, Mater. Eng., Dr. sc. techn. (Ph.D.), 1994

Appointments

2013-pres. Chair, Materials Science and Engineering, *Boise State University*, Boise, ID
2012 Visiting Professor, Physics, *University of Vienna*, Austria
2012-pres. Distinguished Professor, *Boise State University*, Boise, ID
2011-pres. Foundational Studies Program Faculty, *Boise State University*, Boise, ID
2009-pres. Professor, Mater. Sci. & Eng., *Boise State University*, Boise, ID
2006-2011 Director, Boise State Center for Mater. Charact., *Boise State University*, Boise, ID
2004-2009 Associate Professor, Mater. Sci. & Eng., *Boise State University*, Boise, ID
1998-2004 Senior Researcher**,** *ETH Zürich, Inst. of Appl. Phys.*, Zürich, Switzerland
1996-1998 Research Associate**,** *Max-Planck-Inst. fur Metallforsch.*, Stuttgart, Germany
1995 Post-doctoral Researcher**,** *University of Illinois*, Urbana, IL
1991-1994 Research Assistant**,** *ETH Zürich, Inst. of Appl. Phys.*, Zürich, Switzerland
1991-1994 Teaching Assistant**,** *ETH Zürich, Inst. of Appl. Phys.*, Zürich, Switzerland
1990 Research Internship**,** *Alusuisse-Lonza Services AG*, Neuhausen, Switzerland
1988 Research Internship**,** *Contraves AG,* Zürich, Switzerland
1987-1988 Teaching Assistant**,** *ETH Zürich, Dept. of Materials*, Zürich, Switzerland

Publications: 112 published articles, 4 patents granted, 4 patents pending

Awards:

2012 Visiting Professor, Physics, *University of Vienna*, Austria
2012 Distinguished Professor, *Boise State University*, Boise, ID

Synergistic Activities

- Foundational Studies Program Faculty since 2011; developing a university foundations UF100 course for all incoming students; the course is entitled “Invention and Discovery in History and Society”.
- Director of the Boise State Center for Materials Characterization since 2006-2011.
- Organization and instruction of tutorials and teaching workshops including “Magnetic Shape Memory Alloys” at the MRS Fall Meeting 2009, Boston, MA.

- Organization and instruction of the advanced training course 'Materials Science of Thin Films' of the German Society of Materials, Stuttgart, Germany, March 9-11, 1998.
- Co-organizer of the International Conference on Ferromagnetic Shape Memory Alloys, ICFSMA'13, June 3-7 2013, Boise ID;
- Co-organizer of MRS Spring Symposium Z "Materials Structures – The Nabarro Legacy", San Francisco, March 25; 2008
- Guest Editor for *Progress in Materials Science*, Vol. 54, Issue 6, Elsevier August 2009 Special Issue "The Nabarro Legacy – Perspectives for advanced materials in the 21st century".
- Co-organizer of the international workshop 'Magnetic Shape Memory Alloys', Ascona, Switzerland, September 11-16. 2005.
- Guest lectures at the Royal Institute of Technology, Stockholm, Sweden, February 2008;
- Guest lectures at the University of the Basque Country, Bilbao, Spain, July 2010.

List of Collaborators (last 4 years)

Dr. M. Barandiaran (Univ. of Basque Country, Bilbao, Spain), Dr. S. Brinckmann (Ruhr University Bochum, Germany), Dr. V.A. Chernenko (University of the Basque Country, Bilbao, Spain), Dr. G. Dehm (Erich-Schmid Institute, Leoben, Austria), Dr. D. C. Dunand (Northwestern University, Evanston, IL), Dr. G. Hampikian (BSU, Boise, ID), Dr. A. H. King (Ames Laboratory, Ames, IA), Dr. W. B. Knowlton (BSU, Boise, ID), Dr. G. Kostorz (ETH Zürich, Switzerland), Dr. V. Michaud (Ecole Polytechnuique Federal, Lausanne, Switzerland), Dr. R. C. Pond (University of Exeter, Exeter, England), Dr. K. Sassaki (BSU, Boise, ID), Dr. C. Sasso (Instituto Nazionale di ricerca Metrologica, Torino, Italy), Dr. R. Schneider (Hahn-Meitner Institute, Berlin, Germany), Dr. R. Ubic (BSU, Boise, ID), Dr. K. Ullakko (Savonlinna, Finland), Dr. T. Waitz (Technical University Vienna, Austria), Dr. Xuexi Zhang (Harbin Institute of Technology, China).

Advisors and Supervisors

Diploma (M.S.): Dr. C. Solenthaler, Dr. M. O. Speidel (ETH Zürich)
Dr. sc. techn. (Ph.D.): Dr. C. Solenthaler, Dr. M. O. Speidel (ETH Zürich)
Post-doctoral sponsor: Dr. W. M. Kriven (University of Illinois, Urbana-Champaing), Dr. E. Arzt (Max-Planck-Institut fur Metallforschung, Stuttgart), Dr. G. Kostorz (ETH Zürich).

Ph.D. Students advised (Institution and year of graduation in parentheses)

A. Hobza (BSU, starting June 2013), J. Huntsinger (BSU, current), Brittany Muntifering (BSU and Ruhr University Bochum, current), Dr. M. Chmielus (BSU, and Technical University Berlin, Germany, 2010), Dr. A. S. Sologubenko

(ETH Zürich, Switzerland, 2005), Dr. H. Hesemann (University o Stuttgart, Germany, 2002), Dr. J. Greiser (University o Stuttgart, Germany, 2000).

B.

MS and Diploma Students advised (Institution and year of graduation in parentheses)

T. Lawerence (BSU, current), K. Wilson (BSU, current), D. Kellis (BSU, 2011), C. Witherspoon (BSU, 2011), B. Muntifering (BSU, 2011), M. Hagler (BSU, 2008), D. Carpenter (BSU, ID, 2008), M. Chmielus (BSU, 2007), S. Bianchi (ETH Zürich, Switzerland, 2003), B. E. Burgler (ETH Zürich, Switzerland, 2001).

Total number of graduate students advised: 15
Postdoctoral scholars sponsored 2.

Publications

Patents (P)

P4 C. S. Watson, W. B. Knowlton, and P. Müllner, "Data storage methods and devices", US Patent No. US 2012/0236632 A1, Date of Patent: September 20, 2012.

P3 G. Hampikian and P. Müllner, "Magnetomechanical Transducer, and Apparatus and Methods of Harvesting Energy", US Patent No. US 8,008,816, Date of Patent: August 30, 2011.

P2 P. Müllner, M. Chmielus, D. C. Dunand, Y. Boonyongmaneerat, "Magnetic material with large magnetic-field-induced deformation", US Patent No. US 7,964,290 B2, Date of Patent: June 21, 2011.

P1 P. Müllner and W. B. Knowlton, "Multi-state memory and multi-functional devices comprising magnetoplastic or magnetoelastic materials", US Patent No. US 7,710,766 B2, Date of Patent: May 4, 2010.

Papers in regular journals (J)

J68 I. R. Aseguinolaza, J. M. Barandiarán, M. Ohtsuka, P. Müllner, O. Y. Salyuk, V. A. Chernenko, "Martensitic transformation and magnetic anisotropy in Ni-Mn-Ga/NaCl(001) thin films probed by ferromagnetic resonance", Applied Physics Letters 102 (2013) 182401.

J67 C. S. Watson, C. Hollar, K. Anderson, W. B. Knowlton, P. Müllner, "Magnetomechanical Four-State Memory", Advanced Functional Materials (2013) 201203015.

J66 C. Witherspoon, P. Zheng, M. Chmielus, S. C. Vogel, D. C. Dunand, P. Müllner, "Texture and training of magnetic shape memory foam", Acta Matertialia 61 (2013) 2113-2120.

J65 I. R. Aseguinolaza, I. Reyes-Salazar, A. V. Svalov, K. Wilson, W. B. Knowlton, P. Müllner, J. M. Barandiarán, E. Villa, V. A. Chernenko, "Transformation volume strain in Ni-Mn-Ga thin films", Applied Physics Letters 101 (2012) 241912.

J64 U. Gaitzxch, J. Drache, K. McDonald, P. Müllner, P. Lindquist, "Obtaining of Ni-Mn-Ga magnetic shape memory alloy by annealing electrochemically deposited Ga/Mn/Ni layers", Thin Solid Films 522 (2012) 171-174.

J63 K. Ullakko, L.Wendell, A. Smith, P. Müllner, G. Hampikian "A magnetic shape memory microump: contact-free, and compatible with PCR and human DNA profiling", Smart Materials and Structures 21 (2012) 115020.

J62 K. Rolfs, M. Chmielus, J. M. Guldbakke, R. C. Wimpory, A. Raatz, W. Petry, P. Müllner, R. Scheider "Key properties of Ni-Mn-Ga based single crystals grown with the SLARE technique", Advanced Engineering Materials 14/8 (2012) 614-635.

J61 D. Kellis, A. Smith, K. Ullakko, and P. Müllner, "Oriented single crystals of Ni-Mn-Ga with very low switching field", Journal of Crystal Growth 359 (2012) 64-68.

J60 R. C. Pond, B. Muntifering, and P. Müllner, "Deformation twinning in Ni_2MnGa", Acta Materialia 60 (2012) 3976-3984.

J59 U. Gaitzsch, J. Romberg, M Pötschke, S. Roth, and P. Müllner, "Stable magnetic-field-induced strain above 1% in polycrystalline Ni-Mn-Ga", Scripta Materialia 65 (2011) 679-682.

J58 C. P. Sasso, P. Zheng, V. Basso, P. Müllner, and D. C. Dunand, "Enhanced field induced martensitic phase transition and magnetocaloric effect in $Ni_{55}Mn_{20}Ga_{25}$ metallic foams", Intermetallics 19 (2011) 952-956.

J57 M. Chmielus, I. Glavatskyy, J.-U. Hoffmann, V. A. Chaernenko, R. Schneider, and P. Müllner, "Influence of constraints and twinning stress on magnetic-field-induced strain of magnetic shape-memory alloys", Scripta Matertialia 64 (2011) 888-891.

J56 M. Chmielus, C. Witherspoon, K. Ullakko, P. Müllner, and R. Schneider, "Effects of surface damage on twinning stress and the stability of twin microstructures of magnetic shape-memory alloys", Acta Matertialia 59 (2011) 2948-2956.

J55 X. X. Zhang, C. Witherspoon, P. Müllner, and D. C. Dunand, "Effect of pore architecture on magnetic-field-induced strain in polycrystalline Ni-Mn-Ga", Acta Matertialia 59 (2011) 2229-2239.

J54 D. C. Dunand, and P. Müllner, “Size effects on magnetic actuation in Ni-Mn-Ga shape-memory alloys”, Advanced Matertials 23 (2011) 216-232.

J53 M. Chmielus, C. Witherspoon, R. Wimpory, A. Paulke, A. Hilger, X. X. Zhang, D. C. Dunand, and P. Müllner, “Magnetic-field-induced recovery strain in polycrystalline Ni-Mn-Ga foam”, Journal of Applied Physics 108 (2010) 123526.

J52 P. Müllner and A. King, “Deformation of hierarchically twinned martensite”, Acta Materialia 58 (2010) 5242-5261.

J51 M. Reinhold, C. Watson, W. B. Knowlton, and P. Müllner, “Transformation twinning of Ni-Mn-Ga characterized with temperature-controlled atomic force microscopy”, Journal of Applied Physics 107 (2010) 113501.

J50 M. Chmielus, K. Rolfs, R. Wimpory, W. Reimers, P. Müllner, and R. Schneider, “Effects of surface roughness and training on the twinning stress of Ni-Mn-Ga magnetic shape memory alloys”, Acta Materialia 58 (2010) 3952-3962.

J49 J. Guldbakke, M. Chmielus, K. Rolfs, R. Schneider, P. Müllner, and A. Raatz, “Magnetic, mechanical, and fatigue properties of a $Ni_{45.4}$,$Mn_{29.1}Ga_{21.6}Fe_{3.9}$ single crystal”, Scripta Materialia 62 (2010) 875-878.

J48 K. Rolfs, M. Chmielus, R. C. Wimpory, A. Mecklenburg, P. Müllner, and R. Schneider “Double twinning in Ni-Mn-Ga-Co”, Acta Materialia 58 (2010) 2646-2651.

J47 V. A. Chernenko, M. Chmielus, and P. Müllner, “Large magnetic-field-induced strains in Ni-Mn-Ga non-modulated martensite”, Applied Physics Letters 95 (2009) 103104.

J46 M. Chmielus, X. X. Zhang, C. Witherspoon, D. C. Dunand, and P. Müllner, “Giant magnetic-field-induced strains in polycrystalline Ni-Mn-Ga foams”, Nature Materials 8/11 (2009) 863-866.

J45 M. Reinhold, D. Kiener, W. B. Knowlton, G. Dehm, and P. Müllner, “Deformation twinning in Ni-Mn-Ga micropillars with 10M martensite”, Journal of Applied Physics 106 (2009) 053906.

J44 V. A. Chernenko, K. Oikawa, M. Chmielus, S. Besseghini, E. Villa, F. Albertini, L. Righi, A. Paoluzi, P. Müllner, R. Kainuma, and K Ishida, “Properties of Co-alloyed Ni-Fe-Ga ferromagnetic shape memory alloys”, Journal of Materials Engineering and Performance 18/5 (2009) 548-553.

J43 V. Golub, K. M. Reddy, V. A. Chernenko, P. Müllner, A. Punnoose, and M. Ohtuska, “Ferromagnetic resonance properties and anisotropy of Ni-Mn-Ga thin films of different thicknesses deposited on Si substrates”, Journal of Applied Physics 105 (2009) 07A942.

J42 V. A. Chernenko, S. Besseghini, M. Hagler, P. Müllner, M. Ohtuska, and F. Stortiero, "Properties of sputter-deposited Ni-Mn-Ga thin films", Mater. Science and Engineering A 481-482 (2008) 271-274.

J41 P. Müllner, Z. Clark, L. Kenoyer, W. B. Knowlton, and G. Kostorz, "Nano-mechanics and magnetic structure of orthorhombic Ni-Mn-Ga martensite", Mater. Science and Engineering A 481-482 (2008) 66-72.

J40 Y. Boonyongmaneerat, M. Chmielus, P. Müllner, D. Dunand, "Increasing magnetoplasticity in polycrystalline Ni-Mn-Ga by reducing internal constraints through porosity", Physics Review Letters 99 (2007) 247201.

J39 V. A. Chernenko, S. Doyle, M. Kohl, P. Müllner, S. Besseghini, and M. Ohtsuka, "Texture of submicron Ni-Mn-Ga thin films studied by x-ray beam line of synchrotron source", Z.f. Kristallog. 26 (2007) 229-234.

J38 V. A. Chernenko, S. Besseghini, P. Müllner, G. Kostorz, J. Schreuer, and M. Krupa, "Ferromagnetic shape memory materials: underlying physics and practical importance", Sensor Letters 5 (2007) 229-233.

J37 V. A. Chernenko, M. Hagler, P. Müllner, V. A. Kniazkyi, V. A. L'vov, M. Ohtuska, S. Besseghini, "Magnetic susceptibility of martensitic Ni-Mn-Ga film", Journal of Applied Physics 101 (2007) 053909.

J36 P. Müllner, "Between microscopic and mesoscopic descriptions of twin-twin interaction", Int. Journal of Mater. Res. (formerly Z. f. Metallkunde), 97/3 (2006) 205-216.

J35 V. Chernenko, M. Kohl, S. Doyle, P. Müllner, and M. Ohtsuka, "Texture dependence of the martensitic transformation in Ni-Mn-Ga films deposited on alumina", Scripta Materialia 54 (2006) 1287-1291.

J34 A. Al-Ghaferi, P. Müllner, H. Heinrich, G. Kostorz, and J. M. K. Wiezorek, "Elastic constants of equiatomic $L1_0$-ordered FePd single crystals", Acta Materialia 54 (2006) 881-889.

J33 G. Kostorz and P. Müllner, "Magnetoplasticity", Z. f. Metallkunde 96 (2005) 703-709.

J32 A. Sologubenko, P. Müllner, H. Heinrich, and G. Kostorz, "Formation of twinned tetragonal ferromagnetic $L1_0$-MnAl-C alloys", Arch. Metall. Mater. 49/4 (2004) 863-867.

J31 A. S. Sologubenko, P. Müllner, H. Heinrich, and G. Kostorz, "On the plate-like τ-phase formation in MnAl-C alloys", Z. f. Metallkunde 95 (2004) 486-491.

J30 P. Müllner, V. A. Chernenko, and G. Kostorz, "Large magnetic-field-induced deformation and magneto-mechanical fatigue of ferromagnetic Ni-Mn-Ga martensites", Mater. Sci. Eng. A 387-389 (2004), 965-968.

J29 V. A. Chernenko, V. A. L'vov, P. Müllner, G. Kostorz, and T. Takagi, "Magnetic-field-induced superelasticity of ferromagnetic thermoelastic martensites: Experiment and modeling", Phys. Rev. B 69 (2004) 134410.

J28 P. Müllner, V. A. Chernenko, and G. Kostorz, "Large cyclic magnetic-field-induced deformation in orthorhombic (14M) Ni-Mn-Ga martensite", J. Appl. Phys. 95/3 (2004) 1531-1536.

J27 P. Müllner, V. A. Chernenko, and G. Kostorz, "A microscopic approach to the magnetic-field-induced deformation of martensite", J. Magn. Magn. Mater. 267/3 (2003) 325-334.

J26 P. Müllner, V. A. Chernenko, and G. Kostorz, "Stress-induced twin rearrangement resulting in change of magnetization in a Ni-Mn-Ga ferromagnetic martensite", Scripta Mater. 49/2 (2003) 129-133.

J25 H. Th. Hesemann, P. Müllner, O. Kraft, D. Nowak, S. P. Baker, K. Finkelstein, and E. Arzt, "Texture dependence of the martensitic transformation in cobalt thin films", Scripta Mater. 48/8 (2003) 1129-1133.

J24 P. Müllner, V. A. Chernenko, M. Wollgarten, and G. Kostorz, "Large cyclic deformation of Ni-Mn-Ga induced by magnetic fields", J. Appl. Phys. 92/11 (2002) 6708-6713.

J23 P. Müllner, B. E. Bürgler, H. Heinrich, A. S. Sologubenko, and G. Kostorz, "Observation of the shear mode of the $\varepsilon \rightarrow \tau$ transformation in a Mn-Al-C single crystal", Phil. Mag. Lett. 82 (2002) 71-79.

J22 J. Greiser, P. Müllner, and E. Arzt, "Abnormal growth of 'giant' grains in silver thin films", Acta Mater. 49/6 (2001) 1041-1050.

J21 H. Th. Hesemann, P. Müllner, and E. Arzt, "On stress and texture development during martensitic transformation in cobalt thin films", Scripta Mater. 44/1 (2001) 25-30.

J20 P. Müllner and A. E. Romanov, "Internal twinning in deformation twinning", Acta Mater. 48/9 (2000) 2323-2337.

J19 J. Greiser, D. Müller, P. Müllner, C. V. Thompson, and E. Arzt, "Growth of giant grains in silver thin films", Scripta Mater. 41/7 (1999) 709-714.

J18 P. J. Ferreira and P. Müllner, "On a thermodynamic model for the stacking-fault energy", Acta Mater. 46/13 (1998) 4479-4484.

J17 P. Müllner and K. Ullakko, “The force of a magnetic/electric field on a twinning dislocation”, phys. stat. sol. (b) 208 (1998) R1-R2.

J16 P. Müllner, “On the ductile to brittle transition of austenitic steel”, Mater. Sci. Eng. A 234-236 (1997) 94-97.

J15 P. Müllner and P. Pirouz, “A disclination model for twin intersection and the formation of hexagonal Silicon and Germanium”, Mater. Sci. Eng. A 233 (1997) 139-144.

J14 P. Müllner and W. M. Kriven, “On the role of deformation twinning in domain reorganization and grain reorientation in ferroelastic crystals”, J. Mat. Res. 12/7 (1997) 1771-1776.

J13 P. Müllner and C. Solenthaler, “On the effect of deformation twinning on defect densities”, Mater. Sci. Eng. A 230/1-2 (1997) 107-115.

J12 P. Müllner and W.-M. Kuschke, “On the formation of disclinations in fine-grained materials and thin films due to grain boundary relaxation”, Scripta Mater. 36/12 (1997) 1451-1455.

J11 P. Müllner, H. Gao, and C. Ozkan, “A twinned wedge in a Si-Ge epitaxial thin film: twofold Σ=9 twinning”, Phil. Mag. A 75/4 (1997) 925-938.

J10 P. Müllner and P. J. Ferreira, “On the energy of terminated stacking faults”, Phil. Mag. Lett. 73/6 (1996) 289-297.

J9 S. V. Kamat, J. P. Hirth, and P. Müllner, “The effect of stress on the shape of a blocked deformation twin”, Phil. Mag. A 73/3 (1996) 669-680.

J8 P. Müllner, “In-plane edge Somigliana dislocation dipoles and quadrupoles”, Scripta metall. mater. 33/7 (1995), 1181-1186. Ibid. 35/7 (1996) 903.

J7 N. Paulus, P. J. Uggowitzer, P. Müllner and M. O. Speidel, “Cold and warm work of austenitic nitrogen steels”, La Metall. Ital. 86/12 (1994) 603-608.

J6 P. Müllner and A. E. Romanov, “Between dislocation and disclination models for twins”, Scripta Metall. Mater. 31/12 (1994) 1657-1662.

J5 P. Müllner, C. Solenthaler, P. J. Uggwitzer and M. O. Speidel, “Brittle fracture in austenitic steel”, Acta Metall. Mater. 42/7 (1994) 2211-2217.

J4 P. Müllner, C. Solenthaler and M. O. Speidel, “Second order twinning in austenitic steel”, Acta Metall. Mater. 42/5 (1994) 1727-1732.

J3 P. Müllner and C. Solenthaler, "The shape of a blocked deformation twin", Phil. Mag. Lett. 69/4 (1994) 171-175.

J2 P. Müllner and C. Solenthaler, "A proper model of a deformation twin for twin-intersection problems", Phil. Mag. Lett. 69/3 (1994) 111-113.

J1 P. Müllner, C. Solenthaler, P. J. Uggowitzer and M. O. Speidel, "On the effect of nitrogen on the dislocation structure of austenitic stainless steel", Mat. Sci. Eng. A 164 (1993) 164-169.

Edited works (E)

E1 S. B. Sant, P. Müllner, and G. R. Purdy (editors), "The Nabarro Legacy – Perspectives for Advanced Materials in the 21st Century". A collection of invited lectures at the MRS Spring Meeting 2008 in Progress in Materials Science, specially issue 54/6, August 2009.

Contributions to books and edited works (B)

B3 M. Chmielus and P. Müllner, "Effects of surface pinning, locking, and adaption of twins on the performance of magnetic shape-memory alloys", in 'Advances in Magnetic Shape Memory Materials', Materials Science Forum 684 (2011) 175-199.

B2 P. Müllner and G. Kostorz, "Microstructure of magnetic shape-memory alloys: between magnetoelasticity and magnetoplasticity", in 'Advances in Shape Memory Alloys', Ed. V. A. Chernenko, Trans Tech Publications, Materials Science Forum 583 (2008) 43-65.

B1 G. Dehm and P. Müllner, "Dislocations in thin films: Observations", in 'The Encyclopedia of Materials: Science and Technology', Vol. 4, Eds. K. H. J. Buschow, R. W. Cahn, M. C. Flemings, B. Ilschner, E. J. Kramer, S. Mahajan, Elsevier, Oxford 2001, 2329-2331.

Invited conference contributions (I)

I25 *P. Müllner*, C. Watson, C. Hollar, K. Anderson, W. B. Knowlton, "Corrugation-Induced Patterning of Ni-Mn-Ga (100) Surfaces", MRS Spring Meeting 2013, San Francisco, CA, April 2-4, Symp. BBB "Size-Dependent and Coupled Properties of Materials", without proceedings.

I24 *P. Müllner*, B. Muntifering, R. C. Pond, L. Kovarik, N. Browning, "Mechanics of Twinning and Twin Structures in Ni-Mn-Ga", CIMTEC'12 Conference, Symposium B:

State-of-the-Art Research and Application of SMAs Technologies, June 10-14, 2012, Montecatini Terme, Italy, without proceedings.

I23 *P. Müllner*, "Mechanics of magnetic shape memory alloys across the length scales", TMS Spring Conference, Symposium Neutron and X-Ray Studies of Advanced Materials V: Centennial, March 11-15, 2012, Orlando, FL, without proceedings.

I22 *P. Müllner*, "Deformation of materials with complex microstructures: from shifting atoms to moving mountains", International Conference on Martensitic Transformations 'ICOMAT'11', Osaka, Japan, September 4-9, 2011, manuscript submitted to Journal of Alloys and Compounds.

I21 M. Chmielus, K. Ullakko, R. Schneider , *P. Müllner*, "The Role of Constrained Surfaces on Magnetic-Field-Induced Deformation", International Conference on Ferromagnetic Shape Memory Alloys 'ICFSMA'11', Dresden, Germany, July 18-22, 2011, extended abstract book, pp. 209-210.

I20 *P. Müllner*, M. Chmielus, C. Witherspoon, R. Schneider, K. Ullakko "Effects of surface modifications on twinning stress and the stability of twin microstructures of magnetic shape-memory alloys", TMS Spring Meeting, Focus Symposium 'Physical and Mechanical Metallurgy of Shape Memory Alloys', San Diego, CA, February 28-March 3, 2011, without proceedings.

I19 *P. Müllner*, P. Lindquist, K. Wilson, A. Rothenbühler, G. Lindquist, D. Carpenter, K. Ullakko "Inverse magnetoplasticity and power generation using Ni-Mn-Ga", European Materials Research Society symposium 'Shape Memory Materials for Smart Systems', E-MRS-Spring Meeting, Strasbourg, France June 7-11, 2010, without proceedings.

I18 *P. Müllner*, A. H. King "Deformation of hierarchically twinned martensite", Materials Research Society symposium 'Magnetic Shape Memory Alloys', MRS-Fall meeting, Boston, MA November 29-December 2, 2009, without proceedings.

I17 *P. Müllner*, X.X. Zhang, Y. Boonyongmaneerat, C. Witherspoon, M. Chmielus, D.C. Dunand "Recent developments in Ni-Mn-Ga foam research", International Conference on Ferromagnetic Shape Memory Alloys 'ICFSMA'09', Bilbao, Spain, July 1-3, 2009, Materials Science Forum 635 (2010) 119-124.

I16 *P. Müllner*, "Twin microstructure, line defects, and deformation mechanisms of magnetic shape-memory alloys", Proc. of the International Conference on Martensitic Transformations 'ICOMAT'08', Santa Fe, NM, June 29-July5, 2008, (2009) 79-88.

I15 *P. Müllner*, "Twinning in magnetic shape-memory alloys", 'Behavior of Defects in Materials', DoE BES Contractors Meeting, Airlie Conference Center, Warrenton, VA, April 13-16, 2008, without proceedings.

I14 *P. Müllner*, A. S. Geleynse, D. R. Carpenter, M. S. Hagler, and M. Chmielus, "Modeling magnetoplasticity and magnetoelasticity with disconnections and disclinations", Materials Research Society symposium 'Magnetic Shape Memory Alloys', MRS-Fall meeting, Boston, MA November 26-December 30, 2007, MRS Symp. Proc. E 1050 (2008) BB02-01.

I13 *P. Müllner*, "Training, twin-microstructure, and performance of magnetic shape-memory alloy single crystals", Focus meeting SPP 1239, Dresden, Germany Februry 28-March 1, 2007, without proceedings.

I12 *P. Müllner*, M. Chmielus, L. Kenoyer, Z. Clark, M. Reinhold, W. B. Knowlton, and G. Kostorz, "Magnetoplasticity and nano-magneto-mechanics of magnetic shape-memory alloys", Materials Research Society symposium II 'Advanced Intermetallic-Based Alloys', MRS-Fall meeting, Boston, MA November 26-December 1 2006, without proceedings.

I11 *G. Kostorz*, P. Müllner, "Ferromagnetic shape memory alloys", TMS 'XX Conference on Applied Crystallography', Wisla, Poland, September 11-14, 2006, without proceedings.

I10 *P. Müllner*, Z. Clark, L. Kenoyer, W. B. Knowlton, and G. Kostorz, "Nano-mechanics and magnetoplasticity of magnetic shape-memory alloys", 'European Symposium on Martensitic Transformations and Shape-Memory Alloys' (ESOMAT 2006), Bochum, Germany, September 10-15 2006, Mater. Science and Engineering A 481-482 (2008) 66-72.

I9 *P. Müllner*, "Micro- and Nano-magneto mechanics of magnetic shape-memory alloys", 'Physics and Materials', Farewell Symposium for Professor Gernot Kostorz, Zurich, Switzerland, May 31-June 1, 2006, without proceedings.

I8 G. Kostorz, *P. Müllner*, "Martensitic transformations and magnetic shape memory in Heusler alloys", TMS Symposium 'Phase Transformations in Magnetic Materials', San Antonio, TX, USA, March 12-16, 2006, without proceedings.

I7 *P. Müllner*, "Magnetoplasticity", Int. Workshop on 'Magnetic Shape Memory Alloys', Ascona, Switzerland, September 11-16 2005, without proceedings.

I6 *P. Müllner*, D. Mukherji, M. Aguirre, R. Erni, G. Kostorz, "Micromechanics of magnetic-field-induced twin boundary motion", Proc. International Conference 'Solid-Solid Phase Transformations in Inorganic Materials', Phoenix, AZ, USA, May 28-June 3 2005, Warrendale, MA (2005), pp. 171-185.

I5 *P. Müllner*, "Magnetoplasticity: Key to novel sensors and actuators", Symposium 'Future trends in metallurgy and materials development', Düsseldorf, Germany, March 31-April 1 2003, without proceedings.

I4 *P. Müllner*, "Magnetoplasticity: Key to novel sensors and actuators", 6th Budapest-Zürich Seminar in Materials Science, Flüelen, Switzerland, May 26-29 2002, without proceedings.

I3 *P. Müllner*, A. S. Sologubenko, and H. Heinrich, "The ε-τ transformation in Mn-Al-C single crystals", Int. Conference on 'Stability of Materials', Ascona, Switzerland, March 4-10 2001, without proceedings.

I2 *P. Müllner*, "Disclination models for deformation twinning", Int. workshop 'Local lattice rotations and disclinations in microstructures of distorted crystals', Rauschenbach, Germany, April 10-14 2000; Eds. P. Klimanek, A. E. Romanov, B. M. Seefeld, Solid State Phenomena 87 (2002), 227-238.

I1 *P. Müllner*, "Somigliana dislocations and disclinations in epitaxial thin films", 'Semiconductor thin films and multilayers', focus symposium at the APS-Spring-Meeting 1997, Kansas City, MO, March 17-21 1997, without proceedings.

Conference contributions (C)

C86 *T. Waitz (invited)*, C. Mangler, P. Schindler, E. Schafler, P. Müllner, V. Srivastava, R. D. James, "Ultrafine Grained Shape Memory Alloys: Martensitic Phase Ttransformations, Reversibility, Hysteresis", MRS Spring Meeting 2013, San Francisco, CA, April 2-4, Symp. CCC "Novel Functionality by Reversible Phase Transformation", without proceedings.

C85 K. Wilson, *P. Lindquist*, J. Hutnsinger, B. Muntifering, W. B. Knowlton, P. Müllner, "Magnetic and Structural Properties of Ni-Mn-Ga Films Grown via Physical Vapor Co-deposition", MRS Spring Meeting 2013, San Francisco, CA, April 2-4, Symp. BBB "Size-Dependent and Coupled Properties of Materials", without proceedings.

C84 T. Lawrence, A. Smith, P. Lindquist, K. Ullakko, *P. Müllner*, "Localized Morphing and Fracture of Magnetic Shape Memory Alloys", 'Mechanical Behavior and Radiation Effects', DoE BES PI Meeting, Bolger Center, Potomac, MD, March 25-27, 2013, without proceedings.

C83 *B. Muntifering*, L. Kovarik, R. C. Pond, N. D. Browning, P. Müllner, "Intra-Variant Boundary in Non-Modulated Ni-Mn-Ga", TMS Spring Conference, Symposium Physical and Mechanical Metallurgy of Shape Memory Alloys, March 4-8, 2013, San Antonio, TX, without proceedings.

C82 *P. Zheng*, B. Yuan, D. C. Dunand, P. Lindquist, P. Müllner, "Fabricating Tubes of Ni-Mn-Ga Magnetic Shape Memory Alloys by Interdiffusion of Mn and Ga into Ni Tubes", TMS Spring Conference, Symposium Physical and Mechanical Metallurgy of Shape Memory Alloys, March 4-8, 2013, San Antonio, TX, without proceedings.

C81 *R. C. Pond*, B. Muntifering, P. Müllner, "Deformation Twinning in Ni2MnGa", CIMTEC'12 Conference, Symposium B: State-of-the-Art Research and Application of SMAs Technologies, June 10-14, 2012, Montecatini Terme, Italy, without proceedings.

C80 *T. Waitz*, C. Mangler, M. Peterlechner, G. Steiner, A. Kompatscher, T. Antretter, F. D. Fischer, P. Müllner, "Nanostructured shape memory alloys: processing, martensitic phase transformations, properties", CIMTEC'12 Conference, Symposium B: State-of-the-Art Research and Application of SMAs Technologies, June 10-14, 2012, Montecatini Terme, Italy, without proceedings.

C79 *T. Waitz*, C. Mangler, G. Steiner, A. Kompatscher, M. Peterlechner, W. Pranger, T. Antretter, F. D. Fischer, P. Müllner, "Ultrafine-Grained Shape Memory Alloys", TMS Spring Conference, Symposium, March 11-15, 2012, Orlando, FL, without proceedings.

C78 *A. Rothenbühler*, E. Barney Smith, P. Müllner, "Application of image processing to track twin boundary motion in magnetic shape memory alloys", Proc. SPIE Electronic Imaging- Image Processing: Machine Vision Applications V, Burlingame, CA, Vol. 8300. January 25, 2012. Paper 8300-0A.

C77 *M. F. Qian*, X. X. Zhang, C. Witherspoon, I. F. Sun, P. Müllner, "Superelasticity and shape memory effects in polycrystalline Ni-Mn-Ga microwires", International Conference on Martensitic Transformations 'ICOMAT'11', Osaka, Japan, September 4-9, 2011, Journal of Alloys and Compounds (in press).

C76 *T. Waitz*, C. Mangler, G. Steiner, M. Peterlechner, W. Pranger, T. Antretter, F. D. Fischer, P. Müllner, "Nanocrystalline shape memory alloys processed by severe plastic deformation", International Conference on Martensitic Transformations 'ICOMAT'11', Osaka, Japan, September 4-9, 2011, submitted to Journal of Alloys and Compounds.

C75 C. Mangler, *A. E. Kompatscher*, P. Müllner, T. Waitz, "TEM investigation of ferromagnetic shape memory alloys subjected to severe plastic deformation", Microscopy MC 2011 Conference, Kiel, Germany, August 28 - September 2, 2011, conference proceedings article number M2-P538.

C74 *N. Kucza*, B. Siewert, M. Flores Ramos, A. Rothenbühler, P. Müllner, "Grain size distribution and grain growth in polycrystalline Ni-Mn-Ga", International Conference on Ferromagnetic Shape Memory Alloys 'ICFSMA'11', Dresden, Germany, July 18-22, 2011, extended abstract book, pp. 161-162.

C73 *B. Muntifering*, R. C. Pond, P. Müllner, "Twinning Mechanisms in Non-Modulated Ni-Mn-Ga", International Conference on Ferromagnetic Shape Memory Alloys 'ICFSMA'11', Dresden, Germany, July 18-22, 2011, extended abstract book, pp. 159-160.

C72 *C. Watson*, W. B. Knowlton, P. Müllner, "Localized stress-induced twinning in Ni-Mn-Ga single crystals", International Conference on Ferromagnetic Shape Memory Alloys 'ICFSMA'11', Dresden, Germany, July 18-22, 2011, extended abstract book, pp. 197-198.

C71 *U. Gaitzsch*, J. Drache, K. McDonald, P. Müllner, P. Lindquist "Electrochemical Deposition of Ni_2MnGa Martensitic Alloy", International Conference on Ferromagnetic Shape Memory Alloys 'ICFSMA'11', Dresden, Germany, July 18-22, 2011, extended abstract book, pp. 143-144.

C70 C. Mangler, *T. Waitz*, P. Müllner, "Severe plastic deformation of high temperature Ni-Mn-Ga shape memory alloys studied by TEM and DSC", International Conference on Ferromagnetic Shape Memory Alloys 'ICFSMA'11', Dresden, Germany, July 18-22, 2011, extended abstract book, pp. 125-126.

C69 X. X. Zhang, C. Witherspoon, P. Müllner, *D. C. Dunand*, "Magnetic-field-induced strain in porous, polycrystalline Ni-Mn-Ga", International Conference on Ferromagnetic Shape Memory Alloys 'ICFSMA'11', Dresden, Germany, July 18-22, 2011, extended abstract book, pp. 121-122.

C68 *T. Waitz*, W. Pranger, C. Mangler, M. Peterlechner, G. Steiner, T. Antretten, F. D. Fischer, P. Müllner "Nanocrysatlline Shape Memory Alloys", TMS Spring Meeting, Focus Symposium 'Physical and Mechanical Metallurgy of Shape Memory Alloys', San Diego, CA, February 28-March 3, 2011, without proceedings, T. Waitz gave an invited talk.

C67 *P. Zheng*, B. Ye, C. Witherspoon, P. Müllner, D. C. Dunand "Powder metallurgy processing of replicated Ni-Mn-Ga foams", TMS Spring Meeting, Focus Symposium 'Physical and Mechanical Metallurgy of Shape Memory Alloys', San Diego, CA, February 28-March 3, 2011, without proceedings.

C66 *D. Kellis*, K. Ullakko, P. Müllner "Growth of oriented nickel manganese gallium single crystals via the Bridman method", TMS Spring Meeting, Focus Symposium 'Physical and Mechanical Metallurgy of Shape Memory Alloys', San Diego, CA, February 28-March 3, 2011, without proceedings.

C65 *T. Waitz*, C. Mangler, G. Steiner, M. Peterlechner, T. Antretter, F. D. Fischer, W. Pranger, P. Müllner, "Multifunctional shape memory alloys processed by SPD", Proceedings of the International Symposium on Giant Straining Process for Advanced Materials (GESAM 2010), Fukuoka, Japan, November 19-22, 2010, pp.

C64 M. Chmielus, C. Witherspoon, R. Schneider, *P. Müllner*, "Surface damage and twinning stress of Ni-Mn-Ga single crystals", 'Mechanical Behavior and Radiation Effects', DoE BES Contractors' Meeting, Rockville Hilton, Rockville, MD, September 28-October 1, 2010, without proceedings.

C63 *C. Mangler*, M. Kerber, P. Müllner, T. Waitz "Effects of severe plastic deformation on the high temperature magnetic shape memory alloy Ni-Mn-Ga", Joint European Magnetic Symposia JEMS 2010, Kraków, Poland, August 23-28, 2010, without proceedings.

C62 *B. Muntifering*, R. C. Pond, G. Kostorz, P. Müllner, "Electron diffraction of 2M and 14M Ni-Mn-Ga and the analysis of twinning disconnections", European Materials Research Society symposium 'Shape Memory Materials for Smart Systems', E-MRS-Spring Meeting, Strasbourg, France June 7-11, 2010, without proceedings.

C61 *C. Witherspoon*, P. Zheng, M. Chmielus, P. Müllner, D. C. Dunand, "Porosity and magneto-mechanical properties of magnetic shape memory foam", European Materials Research Society symposium 'Shape Memory Materials for Smart Systems', E-MRS-Spring Meeting, Strasbourg, France June 7-11, 2010, without proceedings.

C60 *P. Müllner*, A. H. King "Disclinations and deformation of hierarchically twinned martensite", in 'The Vasek Vitek Honorary Symposium on Crystal Defects', Computational Materials Science and Applications at TMS Spring Meeting, Seattle, WA, February 14-18, 2010, without proceedings.

C59 *M. Chmielus*, K. Rolfs, C. Witherspoon, N. Kucza, W. Raimers, P. Müllner, R. Schneider, "Effecrts of surface preparation and training on twinning stress of Ni-Mn-Ga single crystals", Materials Research Society symposium 'Magnetic Shape Memory Alloys', MRS-Fall meeting, Boston, MA November 29-December 2, 2009, without proceedings.

C58 *D. Kellis*, M. Hagler, V. A. Chernenko, M. Ohtsuka, W. B. Knowlton, P. Müllner, "Effect of film thickness on texture and magnetic anisotropy of Ni-Mn-Ga films on (100) silicon", International Conference on Ferromagnetic Shape Memory Alloys 'ICFSMA'09', Bilbao, Spain, July 1-3, 2009, without proceedings.

C57 *M. Chmielus*, K. Rolfs, C. Witherspoon, W. Raimers, P. Müllner, R. Schneider, "Influence of surface condition and training on the twinning stress of Ni-Mn-Ga magnetic shape-memory alloys", Conference of the German Physical Society, München, Germany, March 2009, without proceedings.

C56 *K. Rolfs*, M. Chmielus, R. C. Wimpory, P. Müllner, W. Petry, R. Schneider, "Influence of alloying Ni-Mn-Ga with cobalt on structural, mechanical and magnetic properties", Conference of the German Physical Society, München, Germany, March 2009, without proceedings.

C55 *P. Müllner*, M. Reinhold, W. B. Knowlton, D. Kiener, G. Dehm, "Magneto-mechanics of Ni-MN-Ga magnetic shape-memory micropillars", MRS Spring Meeting 2009, San Francisco, CA, April 13-17, II "Probing mechanics on nanoscale dimensions", without proceedings.

C54 *P. Müllner*, C. Witherspoon, M. Chmielus, X. Zhang, P. Zheng, D. C. Dunand, "Magneto-mechanics of Ni-MN-Ga magnetic shape-memory micropillars", MRS Spring Meeting 2009, San Francisco, April 13-17, LL "Architectured multifunctional materials", without proceedings.

C53 V. Golub, *K. M. Reddy*, V. A. Chernenko, P. Müllner, A. Punnoose, and M. Ohtuska, "Ferromagnetic resonance properties and anisotropy of Ni-Mn-Ga thin films of different thicknesses deposited on Si substrates", 53rd Conference on Magnetism and Magnetic Materials, Austin, TX, November 10-14, 2008, Journal of Applied Physics 105 (2009) 07A942.

C52 *V. A. Chernenko*, K. Oikawa, M. Chmielus, S. Besseghini, E. Villa, F. Albertini, L. Righi, A. Paoluzi, P. Müllner, R. Kainuma, K. Ishida, "Properties of Co-alloyed Ni-Fe-Ga ferromagnetic shape memory alloys", International Conference on Shape Memory and Superelastic Technologies (SMST 2008), Stresa, Italy, September 21-25, 2008, Journal of Materials Engineering and Performance 18/5 (2009) 548-553.

C51 *M. Reinhold*, W. B. Knowlton, P. Müllner, "Characterizating twin structure and magnetic domain structure of Ni-Mn-Ga through atomic force microscopy", Proc. of the International Conference on Martensitic Transformations 'ICOMAT'08', Santa Fe, NM, June 29-July5, 2008, (2009) 299-304.

C50 *M. Hagler*, V. A. Chernenko, M. Ohtsuka, S. Bessighini, P. Müllner, "Martensitic transformation in Ni-Mn-Ga thin films deposited on alumina", Proc. of the International Conference on Martensitic Transformations 'ICOMAT'08', Santa Fe, NM, June 29-July5, 2008, (2009) 453-457.

C49 *M. Chmielus*, V. A. Chernenko, A. Hilger, G. Kostorz, P. Müllner, R. Schneider, "Magneto-mechanical properties and fracture of mechanically constrained Ni-Mn-Ga single crystals after extended magnetic cycling", Proc. of the International Conference on Martensitic Transformations 'ICOMAT'08', Santa Fe, NM, June 29-July5, 2008, (2009) 683-688.

C48 *D. Carpenter*, M. Chmielus, A. Rothenbühler, R. Schneider, P. Müllner, "Application of ferromagnetic shape-memory alloys in power generation devices", Proc. of the International Conference on Martensitic Transformations 'ICOMAT'08', Santa Fe, NM, June 29-July5, 2008, (2009) 365-369.

C47 M. Chmielus, D. Carpenter, A. Geleynse, M. Hagler, R. Scheider, P. Müllner, "Numerical simulation of twin-twin interaction in magnetic shape-memory alloys", MRS Spring Meeting 2008, San Francisco, March 24-28, Symposium Z "Structure of Materials – The Nabarro Legacy", MRS E Proc. 1090 (2008) Z05-26.

C46 A. Bellou, S. Candelaria, M. Hagler, P. Müllner, D. F. Bahr, "Fracture and deformation in multi-layer metallic films", MRS Spring Meeting, San Francisco, CA, March 24-28, 2008, without proceedings.

C45 V. A. Chernenko, R. Lopez-Anton, S. Besseghini, J. M. Barandiaran, M. Ohtuska, A. Gambardella, P. Müllner, "Magnetization and domain patterns in martensitic NiMnGa films on Si(100) wafer", International Conference on Ferromagnetic Shape Memory Alloys, Kolkata, India, November 14-16, 2007, Advanced Materials Research 52 (2008) 35-43.

C44 S. Doyle, V. A. Chernenko, S. Besseghini, A. Gambardella, M. Kohl, P. Müllner, and M. Ohtsuka, "Residual Stress in Ni-Mn-Ga thin films deposited on different substrates", E-MRS Fall Meeting 2007, Warsaw, Poland, September 17-21, Europ. Phys. J. S. T. 158 (2008) 179-185.

C43 S. Besseghini, A. Gambardella, V. A. Chernenko, M. Hagler, C. Pohl, P. Müllner, M. Ohtuska, and S. Doyle, "Transformation behavior of Ni-Mn-Ga/Si(100) thin film composites with different film thicknesses", E-MRS Fall Meeting 2007, Warsaw, Poland, September 17-21, Europ. Phys. J. S. T. 158 (2008) 179-185.

C42 *M. Chmielus*, V.A. Chernenko, W.B. Knowlton, G. Kostorz, P. Müllner, "Training, constraints, and high-cycle magneto-mechanical properties of Ni-Mn-Ga magnetic shape-memory alloys", E-MRS Fall Meeting 2007, Warsaw, Poland, September 17-21, Europ. Phys. J. S. T. 158 (2008) 79-85.

C41 *M. Hagler*, V.A. Chernenko, M. Ohtsuka, S. Besseghini, P. Müllner, "Magnetic anisotropy, stress, and martensitic transformation in Ni-Mn-Ga thin films on Si(001) wafer", MRS symposium 'Nanoscale magnetics and device applications', MRS-Spring-Meeting 2007, San Francisco, April 9-13, 2007, Mater. Res. Soc. Symp. Proc. Vol 998 (electronic), 0998-J06-09.

C40 *V. A. Chernenko*, S. Doyle, M. Kohl, P. Müllner, S. Besseghini, and M. Ohtsuka, "Texture of submicron Ni-Mn-Ga thin films studied by x-ray beam line of synchrotron source", 'European Powder Diffraction Conference' (EPDIC 2006), Geneva, Switzerland, September 1-4, 2006, Z.f.Kristallography 26 (2007) 229-234.

C39 *V. A. Chernenko*, S. Besseghini, M. Hagler, P. Müllner, M. Ohtsuka, and F. Stortiero, "Properties of sputter-deposited Ni-Mn-Ga thin films", 'European Symposium on Martensitic Transformations and Shape-Memory Alloys' (ESOMAT 2006), Bochum, Germany, September 10-15 2006, Mater. Science and Engineering A 481-482 (2008) 271-274.

C38 *V. A. Chernenko*, S. Besseghini, P. Müllner, G. Kostorz, J. Schreuer, and M. Krupa, "Ferromagnetic shape memory materials: underlying physics and practical importance", '6^{th} European Conference on Magnetic Sensors and Actuators' (EMSA'06), Bilbao, Spain, July 3-5 2006, Sensor Letters 5 (2007) 229-233.

C37 M. Hagler, Z. Clark, L. Kenoyer, M. Chmielus, V. Chernenko, M. Ohtsuka, H. Rumpf, W. B. Knowlton, *P. Müllner*, "Mechanical, magnetic and magneto-mechanical properties

of Ni-Mn-Ga magnetic shape-memory alloy thin films", Gordon Research Conference on 'Thin Film and Small Scale Mechanical Behavior', Waterville, Main, July 30-August 4 2006, without proceedings.

C36 *D. Mukherji*, M. Aguirre, P. Müllner, and G. Kostorz, "Electron diffraction and HREM imaging of the martensitic phase in Ni_2MnGa", MRS symposium 'Multiferroic materials', MRS-Fall-Meeting 2005, Boston, November 27-December 1, 2005, without proceedings.

C35 *M. Aguirre*, D. Mukherji, P. Müllner, and G. Kostorz, "High resolution TEM analysis of structure and microstructure of Ni-Mn-Ga alloys", Int. Workshop on 'Magnetic Shape Memory Alloys', Ascona, Switzerland, September 11-16 2005, without proceedings.

C34 *M. Hagler*, P. Müllner, W. B. Knowlton, A. Punnoose, M. Aguirre, and G. Kostorz, "Magneto-mechanical properties of Ni-Mn-Ga with different microstructures", Int. Workshop on 'Magnetic Shape Memory Alloys', Ascona, Switzerland, September 11-16 2005, without proceedings.

C33 *Z. Clark*, W. B. Knowlton, P. Müllner, M. Aguirre, and G. Kostorz, "Nano-magneto-mechanics of Ni-Mn-Ga Heusler Alloys", Int. Workshop on 'Magnetic Shape Memory Alloys', Ascona, Switzerland, September 11-16 2005, without proceedings.

C32 *A. Sologubenko*, P. Müllner, B. Schönfeld, H. Heinrich, and G. Kostorz, "Coherent formation of plate-like τ-MnAl-C alloys",Int. Workshop on 'Magnetic Shape Memory Alloys', Ascona, Switzerland, September 11-16 2005, without proceedings.

C31 *P. Müllner*, D. Mukherji, M. Aguirre, P. Müllner, R. Erni and G. Kostorz, "Disconnections in 14M Ni_2MnGa", Int. Workshop on 'Magnetic Shape Memory Alloys', Ascona, Switzerland, September 11-16 2005, without proceedings.

C30 *A. Sologubenko*, H. Heinrich, P. Müllner, and G. Kostorz, "Formation of plate-like τ-phase in MnAl-C alloys", MRS Fall-Meeting'04, 11/29-12/3 2004, without proceedings.

C29 *A. Sologubenko*, P. Müllner, H. Heinrich, and G. Kostorz, "Formation of twinned tetragonal ferromagnetic $L1_0$-MnAl-C alloys", Int. Workshop on 'Intelligent Shape Memory and Magnetoelastic Materials', Niedzica, Poland, October 10-13 2004, Arch. Metall. Mater. 49/4 (2004) 863-867.

C28 *P. Müllner*, V. A. Chernenko, D. Mukherji, and G. Kostorz, "Cyclic magnetic-field-induced deformation and magneto-mechanical fatigue of Ni-Mn-Ga ferromagnetic martensites", MRS symposium 'Materials and devices for smart systems', MRS-Fall-Meeting 2003, Boston, December 1-5 2003, MRS Symp. Proc. 785 (2004) 415-420.

C27 *A. Sologubenko*, P. Müllner, H. Heinrich, and G. Kostorz, "TEM study of the $\varepsilon \rightarrow \varepsilon' \rightarrow \tau$ phase transformation in Mn-Al-C alloys", Int. Conf. 'Microscopy Conference', Dresden,

Germany, September 7-12 2003, Microscopy and Microanalysis 9/suppl.3 (2003) 350-351.

C26 *A. Sologubenko*, P. Müllner, H. Heinrich, and G. Kostorz, "The shear-mechanism of τ-MnAl formation", Int. Conf. 'Euromat 2003', Lausanne, Switzerland, September 1-5 2003, without proceedings.

C25 *P. Müllner*, V. A. Chernenko, and G. Kostorz, "Magnetic-field-induced deformation and magneto-mechanical fatigue of Ni-Mn-Ga ferromagnetic martensites", 'International conference on strength of metals and alloys 2003' ICSMA-13, Budapest, August 25-30 2003, Mater. Sci. Eng. A 387-389 (2004) 965-968.

C24 *P. Müllner* and G. Kostorz, "Magnetoplasticity: deformation by magnetic-field-induced motion of twin boundaries", Int. Conf. 'Moving Interfaces', Irsee, Germany, August 10-15 2003, without proceedings.

C23 *V. A. Chernenko*, P. Müllner, M. Wollgarten, J. Pons, and G. Kostorz, "Magnetic field induced strains exhibited by different martensites in Ni-Mn-Ga alloys", 'International Conference of Martensitic Transformations' (ICOMAT '02),, Helsinki, June 10-14 2002, Journal de Physique IV 112 (2003) 951-954.

C22 *A. S. Sologubenko*, P. Müllner, H. Heinrich, M. Wollgarten, and G. Kostorz, "The effect of composition and stress on the selection of ε → τ transformation modes in MnAl-C", 'International Conference of Martensitic Transformations' (ICOMAT '02), Helsinki, June 10-14 2002, Journal de Physique IV 112 (2003) 1071-1074.

C21 H. Th. Hesemann, *P. Müllner*, O. Kraft, and E. Arzt, "Model for hcp martensite: application to Co thin films", 'International Conference of Martensitic Transformations' (ICOMAT '02), Helsinki, June 10-14 2002, Journal de Physique IV 112 (2003) 107-110.

C20 *P. Müllner*, A. S. Sologubenko, and H. Heinrich, "The ε → τ phase transformation in a MnAl-C single crystal", Int. Conf. 'Stability of Materials', Ascona, Switzerland, March 4-10 2001, without proceedings.

C19 *P. Müllner*, "On the interaction of grain boundaries and triple junctions with a free surface", Int. Workshop 'Local Lattice Rotations and Disclinations in Microstructures of Distorted Crystals', Rauschenbach April 10-14 2000, Eds. P. Klimanek, A. E. Romanov, B. M. Seefeld, Solid State Phenomena 87 (2002), 215-220.

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