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14. ABSTRACT Final Report: Monolithic Silicon Microbolometer Materials for Uncooled Infrared Detectors. Research was summarized in two Ph.D. theses that were finished within the period of performance, including a no-cost extension. One was entitled "Thin Film Materials and Devices for Resistive Temperature Sensing Applications" by Hitesh Basantani and the other entitled "Reactive sputter deposition of vanadium, nickel, and molybdenum oxide thin films for use in uncooled infrared imaging" by Yao Jin. This research also resulted in a total of 29 other articles and conference papers.					
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Report Title

Final Report: Monolithic Silicon Microbolometer Materials for Uncooled Infrared Detectors

ABSTRACT

FFinal Report: Monolithic Silicon Microbolometer Materials for Uncooled Infrared Detectors. Research was summarized in two Ph.D. theses that were finished within the period of performance, including a no-cost extension. One was entitled "Thin Film Materials and Devices for Resistive Temperature Sensing Applications" by Hitesh Basantani and the other entitled "Reactive sputter deposition of vanadium, nickel, and molybdenum oxide thin films for use in uncooled infrared imaging" by Yao Jin. This research also resulted in a total of 29 other articles and conference papers.

Enter List of papers submitted or published that acknowledge ARO support from the start of the project to the date of this printing. List the papers, including journal references, in the following categories:

(a) Papers published in peer-reviewed journals (N/A for none)

<u>Received</u>	<u>Paper</u>
01/06/2014 26.00	Adem Ozcelik, Orlando Cabarcos, David L. Allara, Mark W. Horn. Vanadium Oxide Thin Films Alloyed with Ti, Zr, Nb, and Mo for Uncooled Infrared Imaging Applications, Journal of Electronic Materials, (10 2012): 0. doi: 10.1007/s11664-012-2326-9
01/06/2014 29.00	Hang-Beum Shin, David Saint John, Myung-Yoon Lee, Nikolas J. Podraza, Thomas N. Jackson. Electrical properties of plasma enhanced chemical vapor deposition a-Si:H and a-Si _{1-x} C _x :H for microbolometer applications, Journal of Applied Physics, (08 2013): 0. doi: 10.1063/1.4829013
04/09/2012 7.00	Dalong Zhao, Devin A. Mourey, Thomas N. Jackson. Low-Temperature Pulsed-PECVD ZnO Thin-Film Transistors, Journal of Electronic Materials, (11 2009): 0. doi: 10.1007/s11664-009-0995-9
04/09/2012 11.00	Jing Li, Bryan D. Gauntt, Elizabeth C. Dickey. Microtwinning in highly nonstoichiometric VO _x thin films, Acta Materialia, (09 2010): 0. doi: 10.1016/j.actamat.2010.05.035
04/09/2012 10.00	Song Won Ko, Jing Li, Nikolas J. Podraza, Elizabeth C. Dickey, Susan Trolier-McKinstry. Spin Spray-Deposited Nickel Manganite Thermistor Films For Microbolometer Applications, Journal of the American Ceramic Society, (02 2011): 0. doi: 10.1111/j.1551-2916.2010.04097.x
04/09/2012 9.00	N.J. Podraza, D.B. Saint John, S.W. Ko, H.M. Schulze, J. Li, E.C. Dickey, S. Trolier-McKinstry. Optical and structural properties of solution deposited nickel manganite thin films, Thin Solid Films, (02 2011): 0. doi: 10.1016/j.tsf.2010.11.088
04/09/2012 8.00	Chandrasekaran Venkatasubramanian, Orlando M. Cabarcos, William R. Drawl, David L. Allara, S. Ashok, Mark W. Horn, S. S. N. Bharadwaja. Process-structure-property correlations in pulsed dc reactive magnetron sputtered vanadium oxide thin films, Journal of Vacuum Science & Technology A: Vacuum, Surfaces, and Films, (08 2011): 0. doi: 10.1116/1.3636372
04/10/2012 12.00	MingLiang Zhang, D. A. Drabold. The microscopic response method: Theory of transport for systems with both topological and thermal disorder, physica status solidi (b), (05 2011): 0. doi: 10.1002/pssb.201147036
04/10/2012 22.00	D. A. Drabold. Silicon: the gulf between crystalline and amorphous, physica status solidi (RRL) - Rapid Research Letters, (11 2011): 0. doi: 10.1002/pssr.201105444
04/10/2012 21.00	James P. Lewis, Pavel Jelínek, José Ortega, Alexander A. Demkov, Daniel G. Trabada, Barry Haycock, Hao Wang, Gary Adams, John K. Tomfohr, Enrique Abad, Hong Wang, David A. Drabold. Advances and applications in the FIREBALLab initio tight-binding molecular-dynamics formalism, physica status solidi (b), (08 2011): 0. doi: 10.1002/pssb.201147259
04/10/2012 20.00	Bin Cai, D. A. Drabold. Theoretical Studies of Structure and Doping of Hydrogenated Amorphous Silicon, MRS Proceedings, (07 2011): 0. doi: 10.1557/opl.2011.1095
04/10/2012 19.00	Mingliang Zhang, D A Drabold. The work done by an external electromagnetic field, Journal of Physics: Condensed Matter, (03 2011): 0. doi: 10.1088/0953-8984/23/8/085801

- 04/10/2012 18.00 Mingliang Zhang, D. Drabold. Comparison of the Kubo formula, the microscopic response method, and the Greenwood formula, Physical Review E, (01 2011): 0. doi: 10.1103/PhysRevE.83.012103
- 04/10/2012 17.00 D. Drabold, Y. Li, B. Cai, M. Zhang. Urbach tails of amorphous silicon, Physical Review B, (01 2011): 0. doi: 10.1103/PhysRevB.83.045201
- 04/10/2012 16.00 F. Inam, James P. Lewis, D. A. Drabold. Hidden structure in amorphous solids, physica status solidi (a), (03 2010): 0. doi: 10.1002/pssa.200982877
- 04/10/2012 15.00 I. Santos, P. Castrillo, W. Windl, D. A. Drabold, L. Pelaz, L. A. Marqués. Self-trapping in B-doped amorphous Si: Intrinsic origin of low acceptor efficiency, Physical Review B, (01 2010): 0. doi: 10.1103/PhysRevB.81.033203
- 04/10/2012 14.00 Ming-Liang Zhang, D. Drabold. Alternative Approach to Computing Transport Coefficients: Application to Conductivity and Hall Coefficient of Hydrogenated Amorphous Silicon, Physical Review Letters, (10 2010): 0. doi: 10.1103/PhysRevLett.105.186602
- 04/10/2012 13.00 M.-L. Zhang, D. A. Drabold. Phonon driven transport in amorphous semiconductors: transition probabilities, The European Physical Journal B, (08 2010): 0. doi: 10.1140/epjb/e2010-00233-0
- 11/03/2012 2.00 Devin A. Mourey, Dalong A. Zhao, Jie Sun, Thomas N. Jackson. Fast PEALD ZnO Thin-Film Transistor Circuits, IEEE Transactions on Electron Devices, (02 2010): 0. doi: 10.1109/TED.2009.2037178
- 11/03/2012 3.00 E. C. Dickey, T. N. Jackson, N. J. Podraza, H.-B. Shin, D. B. Saint John, M.-Y. Lee, S. K. Ajmera, A. J. Syllaios. Influence of microstructure and composition on hydrogenated silicon thin film properties for uncooled microbolometer applications, Journal of Applied Physics, (08 2011): 0. doi: 10.1063/1.3610422
- 11/03/2012 23.00 H. A. Basantani, S. Kozlowski, Myung-Yoon Lee, J. Li, E. C. Dickey, T. N. Jackson, S. S. N. Bharadwaja, M. Horn. Enhanced electrical and noise properties of nanocomposite vanadium oxide thin films by reactive pulsed-dc magnetron sputtering, Applied Physics Letters, (2012): 0. doi: 10.1063/1.4731240
- 11/03/2012 24.00 N. J. Podraza, B. D. Gauntt, M. A. Motyka, E. C. Dickey, M. W. Horn. Electrical and optical properties of sputtered amorphous vanadium oxide thin films, Journal of Applied Physics, (2012): 0. doi: 10.1063/1.3702451
- 11/03/2012 25.00 Heidi M. Schulze, David B. Saint John, Nikolas J. Podraza, Elizabeth C. Dickey, Susan S. Trolier-McKinstry, A. Feteira, Song Won Ko. Low Temperature Crystallization of Metastable Nickel Manganite Spinel Thin Films, Journal of the American Ceramic Society, (08 2012): 0. doi: 10.1111/j.1551-2916.2012.05201.x

TOTAL: 23

Number of Papers published in peer-reviewed journals:

(b) Papers published in non-peer-reviewed journals (N/A for none)

<u>Received</u>	<u>Paper</u>
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TOTAL:

Number of Papers published in non peer-reviewed journals:

(c) Presentations

Number of Presentations: 0.00

Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

<u>Received</u>	<u>Paper</u>
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11/03/2012	1.00	Mark W. Horn , David L. Allara, Orlando M. Cabarcos, Hitesh A. Basantani, S. S. N. Bharadwaja, Jing Li, Bryan D. Gauntt, Sami Antrazi, Elizabeth C. Dickey. Comparison of ion beam and magnetron sputtered vanadium oxide thin films for uncooled IR imaging, Proc. SPIE 8012. 04-DEC-11, . : ,
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TOTAL: 1

Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Peer-Reviewed Conference Proceeding publications (other than abstracts):ReceivedPaper

- 01/06/2014 28.00 Hitesh A. Basantani, Hang-Beum Shin, T. N. Jackson, Mark W. Horn, Bjørn F. Andresen, Gabor F. Fulop, Charles M. Hanson, Paul R. Norton, Patrick Robert. Vertically integrated pixel microbolometers for IR imaging using high-resistivity VO,
SPIE Defense, Security, and Sensing. 02-MAY-13, Baltimore, Maryland, USA. : ,
- 01/06/2014 27.00 Yao Jin, Hitesh A. Basantani, Adem Ozcelik, Tom N. Jackson, Mark W. Horn, Bjørn F. Andresen, Gabor F. Fulop, Charles M. Hanson, Paul R. Norton, Patrick Robert. High-resistivity and high-TCR vanadium oxide thin films for infrared imaging prepared by bias target ion-beam deposition,
SPIE Defense, Security, and Sensing. 02-MAY-13, Baltimore, Maryland, USA. : ,
- 04/09/2012 5.00 B. D. Gauntt, J. Li, Orlando. M. Cabarcos, Hitesh. A. Basantani, Chandru. Venkatasubramanian, Srowthi. S. N. Bharadwaja, Nikolas. J. Podraza, Thomas. N. Jackson, Dave. L. Allara, Sami. Antrazi, Mark. W. Horn, Elizabeth. C. Dickey. Microstructure of vanadium oxide used in microbolometers,
Infrared Technology and Applications XXXVII. 09-APR-11, Orlando, Florida, USA. : ,
- 04/09/2012 4.00 David. B. SaintJohn, Hang.-B. Shin, Myung.-Y. Lee, Elizabeth. C. Dickey, Nikolas. J. Podraza, Thomas. N. Jackson. Thin film silicon and germanium for uncooled microbolometer applications,
Infrared Technology and Applications XXXVII. , Orlando, Florida, USA. : ,
- 04/09/2012 6.00 Song Won Ko, Jing Li, Myung-Yoon Lee, Elizabeth Dickey, Thomas Jackson, Susan Trolhier-McKinstry. New materials for uncooled IR imaging: nickel manganite thin films grown by spin spray,
Infrared Technology and Applications XXXVII. 09-APR-11, Orlando, Florida, USA. : ,

TOTAL: 5**Number of Peer-Reviewed Conference Proceeding publications (other than abstracts):**

(d) ManuscriptsReceivedPaper**TOTAL:**

Number of Manuscripts:

Books

Received Book

TOTAL:

Received Book Chapter

TOTAL:

Patents Submitted

Patents Awarded

Awards

Graduate Students

<u>NAME</u>	<u>PERCENT SUPPORTED</u>	Discipline
Hitesh Basantani	0.00	
Yao Jin	0.00	
FTE Equivalent:	0.00	
Total Number:	2	

Names of Post Doctorates

<u>NAME</u>	<u>PERCENT SUPPORTED</u>
FTE Equivalent:	
Total Number:	

Names of Faculty Supported

NAME

PERCENT SUPPORTED

FTE Equivalent:

Total Number:

Names of Under Graduate students supported

NAME

PERCENT SUPPORTED

FTE Equivalent:

Total Number:

Student Metrics

This section only applies to graduating undergraduates supported by this agreement in this reporting period

The number of undergraduates funded by this agreement who graduated during this period: 0.00

The number of undergraduates funded by this agreement who graduated during this period with a degree in science, mathematics, engineering, or technology fields:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and will continue to pursue a graduate or Ph.D. degree in science, mathematics, engineering, or technology fields:..... 0.00

Number of graduating undergraduates who achieved a 3.5 GPA to 4.0 (4.0 max scale):..... 0.00

Number of graduating undergraduates funded by a DoD funded Center of Excellence grant for Education, Research and Engineering:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and intend to work for the Department of Defense 0.00

The number of undergraduates funded by your agreement who graduated during this period and will receive scholarships or fellowships for further studies in science, mathematics, engineering or technology fields: 0.00

Names of Personnel receiving masters degrees

NAME

Total Number:

Names of personnel receiving PHDs

NAME

Hitesh Basantani

Yao Jin

Total Number:

2

Names of other research staff

NAME

PERCENT SUPPORTED

FTE Equivalent:

Total Number:

Sub Contractors (DD882)

Inventions (DD882)

Scientific Progress

Final Report: Monolithic Silicon Microbolometer Materials for Uncooled Infrared Detectors. Research was summarized in two Ph.D. theses that were finished within the period of performance, including a no-cost extension. One was entitled "Thin Film Materials and Devices for Resistive Temperature Sensing Applications" by Hitesh Basantani and the other entitled "Reactive sputter deposition of vanadium, nickel, and molybdenum oxide thin films for use in uncooled infrared imaging" by Yao Jin. This research also resulted in a total of 29 other articles and conference papers.

Technology Transfer