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14. ABSTRACT The Armor Ceramics Symposium was held January 27 - February 1 2013 in Daytona Beach, FL as part of the 37th International Conference & Exposition on Advanced Ceramics and Composites. The 11th edition of this symposium consisted of over 70 oral and poster presentations on topics such as Synthesis and Processing, Materials Characterization, Quasi-static and Dynamic Behavior, Modeling, Testing and Evaluation, and Applications. The symposium continues to foster discussion and collaboration between academic, government and industry personnel from around the globe. A peer-reviewed proceedings was published that included 14 papers from this symposium.					
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Report Title

Final Report: Armor Ceramics Symposium 2013 - ACerS 37th International Conference on Advanced Ceramics and Composites

ABSTRACT

The Armor Ceramics Symposium was held January 27 - February 1 2013 in Daytona Beach, FL as part of the 37th International Conference & Exposition on Advanced Ceramics and Composites. The 11th edition of this symposium consisted of over 70 oral and poster presentations on topics such as Synthesis and Processing, Materials Characterization, Quasi-static and Dynamic Behavior, Modeling, Testing and Evaluation, and Applications. The symposium continues to foster discussion and collaboration between academic, government and industry personnel from around the globe. A peer reviewed proceedings was published that included 14 papers from this symposium. The papers were published in The American Ceramic Society's Ceramic Engineering and Science Proceedings (see citation below):

Ceramic Engineering and Science Proceedings, Volume 34, Issue 4; Advances in Ceramic Armor IX; Jerry C. LaSalvia, Editor; Soshu Kiriwara and Sujanto Widjaja, Volume Editors, 2013

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>
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TOTAL:

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: 55.00

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

Received Paper

TOTAL:

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

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

Received Paper

02/11/2015 1.00 Avi Ya'akobovich, Anthony F. Liszkiewicz, Raul Segura, Eric M. Klier, Kevin J. Doherty, Michael C. Golt , Matthew S. Bratcher, Eylam Ran, Felix Aizik, Andrew L. Marshall, Prashant G. Karandikar, Brian P. Givens, E. A. Rodgers, G. Tsoi, J. M. Montgomery, Y. Vohra, S. Toller, E. Strassburger, S. M. Salamone, P. G. Karandikar, A. L. Marshall , Vitaly Paris, Lev Levin, M. K. Aghajanian, J. Q. Zheng, S. E. Horner, Aaron H. Gassman, Zvi Asaf, P. Karandikar, E. Klier, M. Watkins, Brandon McWilliams, M. Aghajanian, D. J. Vuono, K. P. Bortle, P. J. Ritt, J. J. Swab, J. Campbell, P. Karandikar, S. Wong, M. Duke, R. Haber, Minh Vu, J. Singh, L.J. Vandeperre , J.H. Teo, Michael P. Hunt, Michael K. Cinibulk, Carmen M Carney, Kristin A. Keller, Bryan M. Sadowski, Guillermo R. Villalobos, Shyam Bayya, Jasbinder S. Sanghera, A. A. Wereszczak , K. P. Bortle, T. G. Morrissey, M. K. Ferber, M. Fatih Toksoy, Ishwar D. Aggarwal, William Rafaniello, Steve Miller, Nesredin Kedir, Gary Gilde, Kyu Cho, V. DeLucca . Proceedings of the 37th Concerence on Advanced Ceramics and Composites - Armor Ceramics Symposium, 37th International Conference on Advanced Ceramics and Composites. 28-JAN-13, . : ,

TOTAL: 1

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

(d) Manuscripts

Received Paper

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>
FTE Equivalent:	
Total Number:	

Names of Post Doctorates

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

Names of Faculty Supported

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

Names of Under Graduate students supported

<u>NAME</u>	<u>PERCENT SUPPORTED</u>
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

<u>NAME</u>
Total Number:

Names of personnel receiving PHDs

<u>NAME</u>
Total Number:

Names of other research staff

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

Sub Contractors (DD882)

Inventions (DD882)

Scientific Progress

The Army's primary goal is to provide its soldiers with the equipment to do their job and return home safely. A strategic element of the future success of the U.S. military against a myriad of potential threats is the development of lightweight passive protection technologies for air and ground platforms, as well as the individual Soldier. In spite of a lack of complete understanding of material characteristics that contribute to ballistic performance, ceramics are used in many armor systems and will continue to be integral components for future passive protection technologies. This symposium serves as an international venue in which to present and discuss unclassified research which contributes in some way to helping further our understanding of material characteristics at multi-length scales ranging from the atomistic to the continuum.

The 2013 Symposium includes the following proposed general topic areas:

- Synthesis & Processing (conventional and novel, green body forming, densification, surface modification, planar and curved shapes with/without topological features, etc.)
- Manufacturing (process scale-up, machining, quality control, cost-effectiveness, etc.)
- Materials Characterization (chemistry, phases, microstructure, defects, flaws and flaw statistics, bulk, surface, microscopy, spectroscopy, non-destructive, residual stress, etc.)
- Testing and Evaluation (conventional and fundamental ballistics, in-situ/real time and post-test characterization, nondestructive characterization, technique development, wear and erosion, thermal, fatigue, residual stress, life-cycle, etc.)
- Quasi-static and Dynamic Behavior (mechanical properties, low & high-rate, high-pressure, shear, multi-stress state, shock, fracture, fragmentation, damage, inelastic deformation mechanisms, phase transitions, size-scale effects)
- Modeling (material, system, analytical, computational, continuum, atomistic, multi-scale, thermodynamics, mechanics, phenomenological, physically-based, microstructural, damage, inelastic deformation mechanisms, phase transitions, fracture, fragmentation, impact, penetration, residual stress, homogeneous & heterogeneous deformation, failure, size-scale effects, novel numerical techniques, etc.)
- Application (development of laminate systems, integration, fielding and in-service issues, etc.)

In addition, the 2013 Symposium plans to have three special focus topic areas:

- **Transparent Ceramics and Glasses**

Glass is an extremely important protection material for the Army. However, it should be of no surprise, that despite how common glass materials are, there is so much that we don't know or understand with respect to their short/intermediate range structure, defects/flaws, and response to high pressure transient loads.

- **Materials in Extreme Dynamic Environments (MEDE)**

Because it is a new and important program to the Army, the main goal of a focused session on MEDE would be to simply introduce it to the greater community, describe its vision and goals, and hopefully stimulate interest that may lead to potential future collaborations that help to further support the program.

- **Boron-Icosahedral Based Ceramics**

Because of the importance of boron carbide to the Army and MEDE, it is timely to have a state-of-the-art review on this ceramic, as well as other Boron-Icosahedral based ceramics such as Boron, Boron Suboxide, and Aluminum Dodecaboride.

DISSEMINATION OF RESULTS

A proceedings of the conference, including the Armor Ceramics symposium, will be published on a CD-ROM to be distributed to meeting attendees in August 2013. Papers from the Armor Ceramics symposium will also be published in: *Advances in Ceramic Armor IX Ceramic Engineering and Science Proceedings*, Volume 34, Issue 5, 2013.

Technology Transfer