

# 2016 Aerospace Materials for Extreme Environments Program Review

Dr. Ali Sayir | May 9-13, 2016 | Arlington, VA

Basic Research Innovation and Collaboration Center (BRICC)  
4075 Wilson Blvd., Suite 350 | Liberty Room  
Arlington, VA 22203

## DAY 1 - 09 MAY 2016

### COMPUTATIONAL MATERIAL SCIENCE

7:30-7:55	Registration		
7:55-8:00	Welcome	A. Sayir	5
8:00-8:40	(2012 MURI) MOSAIC OF MICROSTRUCTURE: Microstructure Design and the Discovery of Transformational Multiferroics.	R. James University of Minnesota	40
8:40-9:10	Center of Excellence on Integrated Materials Modeling	S. Ghosh JHU	30
9:10-9:30	Morphological Modelling of Heterogeneous Materials	F. Willott ECOLE DES MINES	20
9:30-9:50	Rare Event Simulation for Modeling of Low-Probability Events in Materials Systems	M. Comer PURDUE	20
9:50-10:20	COFFEE		
10:20-10:50	From Atom Probe Tomography Imaging to Microstructural Quantification: An Iterative Optimization Approach	E. Marquis & W. Windl U. MICHIGAN / OSU	30
10:50-11:10	(2013 YIP) A Transformational Approach to Quantify Chemistry at the Atomic Scale	J. LeBeau NCSU	20
11:10-11:30	Control of High-T Ceramic Grain Boundaries with Electric Field and Understanding the Mechanisms of Flash Sintering	J. Luo UCSD	20
11:30-11:50	Continuum-Equivalent Traction Fields: Quantitative Descriptors of Nanoscale Interfaces	H. B. Chew UIUC	20
11:50-12:10	Experiments and Modeling of the Thermo-Mechanical Properties of Micro-Architected Tungsten Coatings	J. El-Awady JOHNS HOPKINS	20
12:10-1:30	LUNCH		

### ENABLING MATERIALS & SYNTHESIS

1:30-1:50	Quantum-Engineered Semiconductor Metamaterials for Giant Non-Reciprocity without Magnetic Effects	A. Alu UT AUSTIN	20
1:50-2:10	Development of Non-Equilibrium Materials with Extraordinary Electronic Properties	D. Vashaee NCSU	20
2:10-2:30	Chalcogenides for Optically and Electrically Pumped Broadly Tunable Mid-IR Lasers (Mirov) - Cr-, and Fe Doped Chalcogenide (Camata) - Theoretical Model (Kawai)	S. Mirov, R. Camata, R. Kawai and V. Fedorov U. ALABAMA	60
2:30-2:50	COFFEE		
2:50-3:10	High Quantum Efficiency and High Purity Rare Earth Doped Crystal for Solid State Cooling: Synthesis and Characterization	M. Sheik-Bahae UNM	20
3:10-3:30	Feasibility and Mechanisms of Chemical Reactions as a Basis for Heat Transfer Media	B. Lear PSU	20
3:30-3:50	(2015 YIP) Toward Bio-Inspired Smart Thermal Spreaders	H. Ghasemi U. HOUSTON	20
3:50-4:10	Multiscale Methods in Beamed Energy Harnessing	B. S. Tilley	20

	Applications	WPI	
	<b>MEETING ADJOURNED FOR THE DAY</b>		

DAY 2 - 10 MAY 2016			
ENABLING MATERIALS & SYNTHESIS			
7:45-8:00	Registration		
8:00-8:20	High Temperature Phase Transformations in the Rare Earth Titanate System	T. Kriven UIUC	20
8:20-8:40	(15RYCOR163) Studies of the Properties of Bulk and Thin Film $\beta$ -Ga <sub>2</sub> O <sub>3</sub> Materials	D. Thomson AFRL	20
8:40-9:00	Beta-Gallium Oxide	J. Speck and S. Ringel UCSB / OSU	20
9:00-9:30	COFFEE		
METAL DIELECTRIC INTERFACE			
9:30-9:50	Oxide Dielectric Breakdown	C. Hin / VIRGINIA TECH	20
9:50-10:10	Atomic-Scale Modeling of Equilibrium and Transport Properties at Metal-Dielectric Interfaces	W. Windl OSU	20
10:10-11:40	The Role of Interfaces in Performance, Degradation, and Breakdown of Non-Linear Dielectrics (Randall) - Structural Point Defect Characterization (Dickey) - Phase Field Prediction of Dielectric Breakdown (Chen) - Predictive science of Point Defects (Irving) - Development of Perovskite Single Crystals (Lee) - Electronic Modification of Electrode Interfaces (Klein)	C. Randall, P. Hopkins, and B. Dickey D. Irving and L.-Q.-Chen, H.Y. Lee, A. Klein PSU / UVA / NCSU DARMSTADT U. GERMANY SUNMOON U. – S. KOREA	90
11:40--12:00	Linear and Nonlinear Spectroscopic Studies of Linear and Nonlinear Dielectrics and Interfaces	S. Greenbaum and Y. Ren HUNTER COLLEGE NY	20
12:00 1:15	LUNCH		
1:15-2:15	Charge Transfer at Metal Dielectric Interfaces in Extreme Environments (Ekerdt) - Physics of Heterostructure (Demkov) - Electron Holography (McCarthy & Smith) - Electrical Characterization (Wallace & Young)	J. Ekerdt and A. Demkov, M.McCartney, C. Young and D. Smith/ UT AUSTIN/ ASU / UT DALLAS	60
2:15-2:25	COFFEE		
2:25-2:45	Millimeter Wave Interactions with High Temperature Materials	B. Hoff AFRL	20
2:45-3:05	Electromagnetic and Thermal Design of Optimal Common Aperture Materials with Ceramics and Composites	J. Park AFRL	20
3:05-3:25	Nonreciprocal Metal-Dielectric Photonic Structures for Electromagnetic Isolation	A. Chabanov UT SAN ANTONIO	20
3:25-3:45	Electron Trap Modification as a Result of Space Weather Exposure in Highly Disordered Materials	R. Hoffmann AFRL	20
3:45-4:05	Development of Acoustic Detection Techniques of Electron Spin Resonance in Dielectric Crystals	S. Tsakadze TBLISI U.- GEORGIA	20
4:05	MEETING ADJOURNED FOR THE DAY		

<b>DAY 3 - 11 MAY 2016</b>			
<b>ENABLING MATERIALS &amp; SYNTHESIS</b>			
<b>7:30-8:00</b>	<b>Registration</b>		
<b>8:00-8:40</b>	(2011 MURI) Template-Directed Directionally Solidified Eutectic Metamaterials (Braun) - 3D Templates (Lewis)	<b>P. Braun and J. Lewis</b> UIUC / HARVARD	<b>40</b>
<b>8:40-9:00</b>	Novel Metamaterials and Plasmonic Materials Properties enabled by Directional Eutectic solidification	<b>D. Pawlak</b> ITME - POLAND	<b>20</b>
<b>9:00-9:15</b>	ANFF – A Platform for International Collaboration	<b>R. Hicks</b> ANNFF-AUSTRALIA	<b>15</b>
<b>9:15-9:30</b>	South African Mineral Research	<b>A. Kapito</b> MINTEK – SOUTH AFRICA	<b>15</b>
<b>9:30-10:00</b>	<b>COFFEE</b>		
<b>10:00-11:10</b>	Nonlinear Terahertz Studies of Electro-Optic and Magneto-Electric Materials (Khodaparast) - Multiferroic Materials (Priya) - Non-Linear Ultrafast Field Imaging (Raschke) - Theory of Non-Linear Optical Eff.(Belyanin & Stanton)	<b>G. Khodaparast, S. Priya, M. B. Raschke, A. Belyanin and C. Stanton</b> VIRGINIA TECH / U.COLORADO / U. FLORIDA	<b>70</b>
<b>11:10-11:30</b>	Nanoscale probing of Magnetoelectric Phases using Coherent X-ray Photons and Neutrons	<b>E. Fohrtung</b> NM STATE	<b>20</b>
<b>11:30-12:30</b>	<b>LUNCH</b>		
<b>12:30-12:50</b>	(2014 YIP) Molecular Models to Investigate Diamagnetic Anisotropy: Directed Synthesis of Rare-Earth Free Magnets	<b>D. Freedman</b> NORTHWESTERN	<b>20</b>
<b>12:50-1:30</b>	Density Functional Theory Study of Oxide Surfaces and Interfaces / Scanning Tunneling Microscopy Investigation of	<b>M. Skowronski, D. Xi and R. M. Feenstra</b> / CMU	<b>40</b>
<b>1:30-2:00</b>	<b>COFFEE</b>		
<b>2:00-3:30</b>	Quantitative Identification of Electro-Physical Properties of Hetero-Interfaces at Extreme Environments (Sehirlioglu) - Electronic Structure & Point Defects (Lambert) - Nanostructural Investigation (Berger) - Transport Effects (Gao) - Vacancy Mediated Multifunctionality (Lu)	<b>A. Sehirlioglu, W. Lambrecht M. H. Berger, X. Gao, and W. Lu</b> CWRU / ECOLE DES MINES – PARIS - FRANCE / U. MICHIGAN	<b>90</b>
<b>3:30-4:30</b>	Thermodynamic Stability of the Q-2 DEG at the Oxide/Oxide Interface under Extreme Thermomechanical Conditions	<b>A. Demkov, J. Ekerdt, D. Smith</b> UT AUSTIN / ASU	<b>60</b>
<b>4:30</b>	<b>MEETING ADJOURNED FOR THE DAY</b>		

DAY 4 - 12 MAY 2016			
ENABLING MATERIALS & SYNTHESIS			
7:30-8:00	Registration		
8:00-8:20	Toward a Phenomenological Theory of Transport Phenomena in Molten Sulfide system	A. Allanore MIT	20
8:20-8:40	(2013 YIP) DNA-Templated Fabrication of Arbitrary-Structured Porous Carbon Materials	H. Liu U. PITTSBURGH	20
8:40-9:00	In Situ Studies of Thermal, Chemical and Mechanical Stabilities of Refractory Materials	S. Kodambaka UCLA	20
9:00-9:20	(2014 YIP) Understanding the stability and Microstructure of the Zeta Phase in Transition Metal Carbides and Nitrides	C. Weinberger DREXEL	20
9:20-9:40	Influence of Group IV& V Alloying Elements on the Microstructure Engineering and Deformation in TaC	G. Thompson U. ALABAMA	20
9:40-10:00	Scalable, Solution-Phase Routes Towards Metal Carbides	J. Goldberger OSU	20
10:00-10:30	COFFEE		
10:30-10:50	Fracture Toughness of Ultra-High Temperature Ceramics	B. Fahrenholtz & M. AsleZaeem MS & T	20
10:50-11:10	Mechanical Properties and Creep Deformation and Durability of Ultra High Temperature Ceramics	M. Ruggles-Wrenn AFIT	20
11:10-11:30	Silicon Carbide Composites	Y. Svetlana NC CPMRM RK KAZAKSTAN	20
11:30-11:50	Design and Assessment of Multifunctional Coatings for Ablation and Emissivity Performance	R. Trice PURDUE	20
11:50-12:10	Thermoregulating Coating for Space Vehicles	V. Baghramyan ACAD. OF SCIENCES ARMENIA	20
12:10-1:10	LUNCH		
1:10-1:30	Fabrication and Characterization of Novel Refractory Coatings using Combinatorial Nanocalorimetry	J. Vlassak HARVARD U.	20
1:30-1:50	Elucidating Actuation-Induced Failure Mechanisms in High Temperature Shape Memory Alloy	I. Karaman TEXAS A&M	20
1:50-2:10			20
2:10-2:40	COFFEE		
2:40-3:00	Plasma/Electrode Interactions in Plasma Propulsion and High Current Density Environments	E. Choueiri and J. Polk PRINCETON U. / JPL	20
3:00-3:20	Cathode Materials for Electron Emission	T. Back AFRL	20
3:20-4:00	Micro-Engineered Material Surfaces for Electric Propulsion and Pulsed Power	N. Ghoniem, I. Kaganovich, Y. Raites UCLA / PRINCETON U.	40
4:00	MEETING ADJOURNED FOR THE DAY		

	<b>DAY 5 - 13 MAY 2016 -- ONE TO ONE MEETINGS</b>	<b>8 AM - NOON</b>	
	<b>PLEASE SIGN UP WITH MS. KATHY RAGSDALE</b>		
<b>Time</b>	<b>Name</b>		
<b>8:00-8:20</b>	Antoine Allanore		
<b>8:20-8:40</b>	Alp Sehirlioglu, Marie-Helene Berger and Xuan Gao		
<b>8:40-9:00</b>	Mike Squillante		
<b>9:00-9:20</b>	Yiquan Wu		
<b>9:20-9:40</b>			
<b>9:40-10:00</b>			
<b>10:00-10:20</b>	Giti Khodaparast		
<b>10:20-10:40</b>			
<b>10:40-11:00</b>			
<b>11:00-11:20</b>			
<b>11:20-11:40</b>			
<b>11:40-12:00</b>			