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A Proposal for the Organization of the Sixth Workshop on Wide Bandgap Nitrides

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This workshop brought together researchers worldwide to discuss semiconductor nitrides. This workshop provided an open forum which facilitated exchange of knowledge and information about recent developments in equipment, growth methods, growth issues particular to each method including lateral growth and associated spatial migration rates, new theoretical findings, dopant (both n and p type) incorporation and likely approaches to be employed, and potential applications to emitters, detectors and electronic devices.

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Final Report, to be submitted to ARO and ONR, on

A PROPOSAL FOR THE ORGANIZATION OF THE SIXTH WORKSHOP ON WIDE BANDGAP NITRIDES

HELD MARCH 12-15, 2000 IN RICHMOND VA USA

SUBMITTED BY HADIS MORKOÇ
VCU

The workshop was a very successful one and attended by some 140 active researchers in the field. Over 120 abstracts were received and some 80 oral presentations heard in addition to some 20 poster papers. Technical Summary, Attendees List, Oral Presentation Program and Poster Presentation Program are attached as part of this final report.

Technical Summary of the Workshop

The workshop was organized by a group led by Cole Litton (Program Chair), with Hadis Morkoç (Local Arrangements Chair) responsible for the local arrangements. The venue was the Omni Richmond Hotel. The local arrangements were excellent.

In the following some selected topics treated in the workshop will be highlighted, we do not intend to provide a full coverage of all presentations and discussions.

Bulk growth and HVPE.
An update report was given on bulk growth from solution under slight overpressure. A GaN boule size of 20-mm length was reported. Growth on single crystalline GaN seeds is now pursued, and the produced material is on the way to being single crystalline. No further details were provided, neither on growth conditions (solvent used) nor on properties of the produced material.

Growth of bulk AlN with sublimation transport was discussed. Up to 13 mm diameter boules were produced, so far polycrystalline. The dislocation density was claimed to be below $5\ 10^{-4}\ cm^{-3}$.

Preliminary results were presented from low temperature ammono-thermal growth of GaN and AlN. Small mm size crystals were obtained. But so far no seeded growth has been accomplished.

Several reports were given on the growth of thick epilayers with the HVPE technique. By growing very thick GaN layers on sapphire a dislocation density of about $3\ 10^{6}\ cm^{-2}$ at the top surface was reported. Production of thick freestanding layers by growth on LGO substrates and subsequent etching was reported, a size of 2" was predicted soon. There was a rumor that a company in Japan will soon offer thick 2" freestanding GaN wafers, from growth on GaAs.

MOVPE growth
The LEO technique was discussed, and the growth of LEO-PENDEO GaN has now been successfully demonstrated on silicon substrates. Another study reported on in situ XRD experiments monitoring the development of tilt during LEO growth of GaN on sapphire with a SiO_2 masking. Clearly the tilt does develop during growth, only a very small part of it has to do with cool-down stress. The temporal development of tilt during growth was displayed. The growth conditions may be optimized to minimize this tilt, in order to avoid a large dislocation density in the coalescence region of the overgrown layers.

Properties of GaN.
MOVPE grown GaN buffer layers on sapphire were shown to have a resistivity that depended on the dislocation density. Varying the growth conditions (such as reactor pressure) the dislocation density could be systematically controlled, with a strong correlation with the resistivity of the layer. Acceptor states related to the threading dislocations were held responsible for this effect, which is important for FET devices grown on GaN.

Schottky barrier measurements of the vertical transport properties in MBE grown GaN layers were presented. It was concluded that the vertical mobility in such layers is less affected by the dislocations, i e while the lateral mobility was 200 cm^2/Vs the vertical mobility was in the range 1000 cm^2/Vs at room temperature.

A careful study of Mg doped GaN layers was presented, comparing SIMS, Hall data, EPR and ODMR. The Hall concentration tracks well with the uncompensated Mg concentration found in EPR (4 10^{19} cm^{-3}). A concentration of compensating donors in the 10^{18} cm^{-3} range was found, of unknown origin (not Si or O). Interestingly the blue PL emission in this material was suggested to be connected with a shallow donor from ODMR data, i e not a deep donor as commonly believed.

Profiling studies of point defects in thick (about 50 μm) HVPE grown GaN layers were reported. While the concentration of Ga vacancies strongly increased towards the substrate (positron annihilation data) the yellow luminescence (YL) intensity appeared to have a strong opposite trend. This is in disagreement with the previous wisdom from MOVPE layers.

QW structures
Theoretical estimates of the exciton binding energy in AlGaN/GaN QWs were presented. It was concluded that the polarization fields as well as the screening effects by photo-induced carriers in optical experiments have a dramatic effect on the exciton binding energy, which may be reduced to about 10 meV. Under these conditions it is questionable whether the room temperature PL emission is of excitonic character, it should rather be free carrier recombination. Similar arguments would apply to InGaN/GaN QWs.

The electron mobility for the 2DEG in AlGaN/GaN structures grown on low dislocation density ($<10^{-4}$ cm^{-3}) GaN substrates showed a record value of about 60.000 cm^2/Vs at low temperatures.

Inter-subband electron transitions were studied in AlGaN/GaN MQWs. Absorption data for structures grown with $0.45 < x < 0.8$ showed absorption bands in the range 1.8 - 4 μm. Such structures might be of interest for THz optical modulators.

Devices
Status reports were given for several devices, including lasers, MODFETs, HBTs and photodetectors. We shall not give details here. It appears like high performance MODFETs may be produced at moderately high dislocation densities, but the device characteristics are influenced by defects, and possible long-term degradation problems have not yet been much studied. PNP HBTs were reported, these are easier to make (compared to NPN) since the p-doping bottleneck is avoided. A future design with a transferred substrate bottom collector was suggested. HBTs will be more sensitive to the dislocation density than MODFETs. Solar blind UV detectors showed very promising data, the performance was already rather close to the stringent specifications for military use.

Oral Presentation Program:

Session	Time	Abstract #	Authors (Presenter's Name in Bold)	Contact e-mail	Title of Talk
MA-1	**8:15**		***Bulk and Composite Substrates - Richard Molnar, Robert Davis***		
MA-1.1	**8:20**	24	**R. P. Vaudo**	bvaudo@atmi.com	Hydride Vapor Phase Epitaxy for Nitride Substrates
MA-1.2	**8:30**	79	**Leo J. Schowalter, J. Carlos Rojo, N. Yakolev, Y. Shusterman, and G. Slack**	schowl@rpi.edu	Preparation and Characterization of Single-crystal Aluminum Nitride Substrates
MA-1.3	**8:40**	31	**M. Callahan, M. Suscavage, D. Bliss, P. Yip, S. Wang, D. Schwall, L. Bouthillette, J. Bailey, M. Harris, D. Look, D. Reynolds, R. Jones, C. Litton, H. Morkoç, and M. Reshchikov**	Michael.Callahan@hanscom.af.mil	High Quality Hydrothermal Growth and Surface Preparation of Zinc Oxide Crystals for use as III-Nitride Substrates
MA-1.4	**8:50**	36	**V. Dmitriev, Yu. Melnik, V. Ivantsov, A. Nikolaev, V. Sukhoveev, I. Nikitina**	vladimir@tdii.com	Development of AlN and GaN substrate materials
MA-1.5	**9:00**	48	**Y. Shi, Z. Y. Xie, L. H. Liu, B. Liu and J. H. Edgar**	yshi@ksu.edu	Influence of Buffer Layer and 6H-SiC Substrate Polarity on the Nucleation of AlN Grown by the Sublimation Sandwich Technique
MA-1.6	**9:10**	28	**H. P. Maruska, J. Gallagher, B. Chai, T. Anderson, O. Kryliouk**	maruska@gdi.net	Large Area Nitride Substrates Using a Lattice-Matched Template
MA-1.7	**9:20**	69	**Joseph W. Kolis**	Kjoseph@clemson.edu	Approaches to Bulk Single Crystals of GaN in Supercritical Ammonia
MA-1.8	**9:30**	39	**D. R. Gilbert, R. K. Singh, R. Abbaschian, R. Chodelka, F. Kelly, S. Pearton, A. Novikov, N. Patrin, and J. Budai**	dgilb@mail.mse.ufl.edu	High Pressure Synthesis of GaN Crystals
MA-1HT	**10:00**		**10:00-10:20 AM: Open Discussion & Hot Topics; 10:20-10:40 AM: Coffee Break**		
MA-2	**10:40**		***Structural Characterization and ELO Templates - Fernando Ponce, Zuzanna L-Weber, Robert Davis***		
MA-2.1	**10:40**	1	**Zuzanna Liliental-Weber**	z_liliental-weber@lbl.gov	Effect of impurities and dopants on defect formation in GaN

MA-2.2	**10:50**	58	**K. Lorenz, V. Narayanan, W. Kim and S. Mahajan**	Katharina.Lorenz@asu.edu	Defects in GaN nucleation layers grown on (0001) sapphire
MA-2.3	**11:00**	42	**L. Robins, J. Armstrong, C. Bouldin, A. Paul, J. Woicik, C. Parker, J. Roberts, S. Bedair, E. Piner, M. Reed, N. El-Masry, K. Miyano, S. Donovan, and S. Pearton**	lawrence.robins@nist.gov	Optical and structural characterization of compositional inhomogeneity in strain-relaxed indium gallium nitride films
MA-2.4	**11:10**	34	**M. Twigg, R. Henry, D. Koleske, and A. Wickenden**	twigg@estd.nrl.navy.mil	Dependence of extended defects in GaN on hydrogen and alkyl flow rates
MA-2.5	**11:20**	6	**R. Davis, T. Gehrke, K. J. Linthicum, T. S. Zheleva, E. A. Preble, P. Rajagopal, C. A. Zorman, M. Mehregany**	Robert_Davis@ncsu.edu	Lateral and pendeo-epitaxial growth and characterization of gallium nitride and related materials on 6H-SiC(0001) and Si(111) substrates
MA-2.6	**11:30**	49	**Q. Fareed, V. Adivarahan, J. Zhang, M. Asif Khan, J. W. Yang, G. Simin, R. Gaska, and M. S. Shur**	fareed@engr.sc.edu	Epitaxial Lateral Overgrowth of GaN on SiC Substrates With Vertically Conducting Buffers
MA-2.7	**11:40**	87	**P. Fini, G.B. Stephenson, C. Thompson, A. Munkholm, J. Eastman, R. Murty, S.P. DenBaars, and J.S. Speck**	fini@engineering.ucsb.edu	In Situ, Real-Time X-ray Diffraction Measurements of Wing Tilt in Laterally Overgrown GaN
MA-2.8	**11:50**	89	X. Zhang, P. D. Dapkus, and D. H. Rich	dapkus@usc.edu	Sparse GaN Nucleation Technique and Its Application to Direct Lateral Epitaxy Overgrowth of GaN on Sapphire
MA-2HT	**12:10**		**12:10-12:40 PM: Open Discussion & Hot Topics; 12:40-2:00 PM: Break for Lunch, Omni Hotel**		
Session	**Time**	**Abstract #**	**Authors (Presenter's Name in Bold)**	**Contact e-mail**	**Title of Talk**
MP-1	**2:00**		***III-Nitride Optoelectronic Devices - Steve DenBaars, Joe Campbell***		
MP-1.1	**2:00**	85	**M. Hansen, P. Fini, L. Zhao, J. S. Speck, and S. P. DenBaars**	monica@engineering.ucsb.edu	Improved Characteristics of InGaN Multi-Quantum Well Laser Diodes Grown on Laterally Epitaxially Overgrown GaN on Sapphire
MP-1.2	**2:10**	97	**John Edmond**	John_Edmond @Cree.com	Status of nitride based emitters on SiC

MP-1.3	**2:20**	78	**M. Osinski, G. A. Smolyakov, V. A. Smagley, C. -S. Fu, and P. G. Eliseev**	osinski@chtm.unm.edu	Design of InGaN/GaN/AlGaN VCSELs using electrical-thermal-optical- simulator
MP-1.4	**2:30**	23	**S. Bidnyk, J. B. Lam, B. D. Little, and J. J. Song**	bidnyk@mail.com	Recent progress in the development of (Al, Ga)N lasing structures for near-and deep-ultraviolet emitters
MP-1.5	**2:40**	64	**V. Adivarahan, M. Shatalov, A. Lunev, J. W. Yang, G. Simin and M. Asif Khan**	adivarah@engr.sc.edu	Vertically conducting quaternary AlInGaN/GaN quantum well Light Emitting Devices over SiC substrates
MP-1.6	**2:50**	29	**A. J. Steckl, J. Heikenfeld, M. Garter, R. Birkhahn, D. S. Lee, and L. C. Chao**	a.steckl@uc.edu	Rare Earth Doped GaN Electroluminescent Devices
MP-1.7	**3:00**	13	**V. Fuflyigin, A. Osinsky, F. Wang, P. Vakhutinsky, and P. Norris**	vladf@nzat.com	Integrating ferroelctric oxides with III-nitride semiconductors: processing issues and device opportunities
MP-1.8	**3:10**	74	**J. I. Pankove, J. T. Torvik, A. Goulagov, and C. Menoni**	pankove@indra.com	Hot-Electron-Driven Semiconductor Lasers
MP-1HT	**3:30**		**3:30-4:00 PM: Open Discussion & Hot Topics; 4:00-4:20 PM: Coffee Break**		
MP-2	**4:20**		***III-Nitride Epitaxial Growth (MOCVD and CVD) - Russell Dupuis, Kathy Doverspike***		
MP-2.1	**4:30**	98	**Kathy Doverspike**	Kathy_Doverspike@Cree.com	Growth of Nitrides on SiC
MP-2.2	**4:40**	33	H. Protzmann, M. Luenenbuerger, M. Bremser, M. Heuken and H. Juergensen	mb@aixtron.com	MOVPE of group-III-nitrides grown on 5x3 inch sapphire substrates in planetary reactors
MP-2.3	**4:50**	47	**D. Koleske, A. Wickenden, and R. Henry**	koleske@estd.nrl.navy.mil	GaN decomposition in ammonia and its relationship to the GaN growth rate
MP-2.4	**5:00**	60	**Wook Kim, Mario Gonsalves, Vijay Narayanan and S. Mahajan**	wook.kim@asu.edu	Defects in AlN nucleation and GaN epitaxial layer grown on c-plane sapphire substrate by MOCVD
MP-2.5	**5:10**	52	**G. Simin, J. Yang, M. Asif Khan, X. Hu, W. Knap, E. Frayssinet, R. Gaska, M. Shur, P. Prystawko, M. Leszczynski, I. Grzegory, and S. Porowski**	simin@engr.sc.edu	High-density 2D electron gas in AlGaN/GaN heterostructures over bulk GaN Substrates
MP-2.6	**5:20**	94	**M. Seyboth, C. Kirchner, and M. Kamp**	matthias.seyboth@e-technik.uni-ulm.de	MOVPE Growth of AlGaN: Experiment and Modelling

MP-2.7	**5:30**	95	**H. Y. A. Chung, C. Wang, M. Kamp**	hin-yin.chung@e-technik.uni-ulm.de	Hydride Vapour Phase Epitaxy Growth of GaN Layers under reduced Reactor Pressure
MP-2.8	**5:40**	53	M. Callahan, M. Harris, M. Suscavage, D. Bliss, J. Bailey, and M. Alexander	Michael.Alexander@hansco m.af.mil	Chemical vapor reaction process for III-N growth
MP-2HT	**6:00**		**6:00-6:20 PM: Open Discussion & Hot Topics**		
Dinner	**7:00**		**7:00-8:30 PM: Workshop Buffet Dinner, Omni Hotel**		
Rump	**8:30**		**8:30-10:00 PM: Rump Session, Omni Hotel**		
Session	**Time**	**Abstract #**	**Authors (Presenter's Name in Bold)**	**Contact e-mail**	**Title of Talk**
TA-1	**8:00**		***III-Nitride Epitaxial Growth (MBE) - Tom Myers, Randall Feenstra, Cole Litton***		
TA-1.1	**8:00**	91	**B. Heying, C. Elsass, Y. Schmorchkova, E. Haus, L. Chen, P. Fini, S. DenBaars, U. Mishra, and J. Speck**	benh@mrl.ucsb.edu	Nitrides by rf-assisted MBE on MOCVD-grown GaN
TA-1.2	**8:10**	5	**H. Tang, J. B. Webb, and J. A. Bardwell**	Haipeng.Tang@nrc.ca	Reproducibility of growing high quality GaN MODFET structures by reactive (ammonia) MBE
TA-1.3	**8:20**	30	C. Lee, H. Chen, V. Ramachandran, R. M. Feenstra, W. Sarney and L. Salamanca-Riba, D. Look, W. J. Choyke, R. Devaty, J. Northrup, T. Zywietz, J. Neugebauer, and D. Greve	feenstra@andrew.cmu.edu	Heteroepitaxy of GaN on SiC, and studies of Surface Structure
TA-1.4	**8:30**	43	**Tom Myers**	tmyers@wvu.edu	Mg Incorporation Kinetics During rf Plasma MBE Growth
TA-1.5	**8:40**	2	**S. Guha, N. Bojarczuk, M. A. L. Johnson, J. Schetzina**	guha@us.ibm.com	Luminescent gallium nitride based nanostructures on silicon substrates: facetted pillars and flowerlike strings
TA-1.6	**8:50**	73	M. A. Reshchikov, J. Cui, F. Yun, A. Baski, M. I. Nathan, R. Molnar and H. Morkoç	hmorkoc@vcu.edu	GaN Quantum Dots
TA-1.7	**9:00**	9	**H. M. Ng, C. Gmachl, S. N. G. Chu, F. Capasso and A.Y. Cho**	hmng@lucent.com	Growth of AlGaN/GaN superlattices for intersubband transitions

TA-1.8	**9:10**	84	**H. Lamb, A. McGinnis, D. Thomson and R. Davis**	lamb@eos.ncsu.edu	Epitaxial Growth of GaN Using Seeded Supersonic Molecular Beams
TA-1HT	**9:30**		**9:30-10:00 AM: Open Discussion & Hot Topics; 10:00-10:20 AM: Coffee Break**		
TA-2	**10:20**		***Optical Characterization of III-Nitrides, Alloys and Modeling - Bo Monemar, John Zavada***		
TA-2.1	**10:20**	96	**B. J. Skromme and G. L. Martinez**	skromme@asu.edu	Optical signatures of donors and acceptors in GaN
TA-2.2	**10:30**	56	U. Ozgur, M. Bergmann, H. Casey, Jr., H. Everitt, A. Abare, S. Keller, and S. Denbaars	everitt@aro-emh1.army.mil	Sub-picosecond optical measurements of carrier relaxation in InGaN multiple quantum wells
TA-2.3	**10:40**	55	**M. Wraback, H. Shen, J. C. Carrano, T. Li and J. C. Campbell**	mwraback@arl.mil	Optical Time-of-Flight Measurement of the Electron Velocity-Field Characteristic in GaN
TA-2.4	**10:50**	76	H. K. Kwon, C. J. Eiting, D. J. H. Lambert, M. M. Wong, and R. D. Dupuis	dupuis@mail.utexas.edu	Time-Resolved Photoluminescence Studies of AlxGa1-xN/GaN Heterostructures Grown by MOCVD
TA-2.5	**11:00**	18	G. Pozina, J. P. Bergman, B. Monemar, T. Takeuchi, H. Amano, and I. Akasaki	bom@ifm.liu.se	Multiple peak luminescence due to surface damage in InGaN/GaN multiple quantum well structures
TA-2.6	**11:10**	20	**H. J. Lozykowski, W. M. Jadwisienczak and I. Brown**	lozykows@bobcat.ent.ohiou.edu	Luminescence of GaN Doped with Rare Earth
TA-2.7	**11:20**	16	**M. Reed, N. El-Masry, C. Parker, J. Roberts, and S. Bedair**	mjreed@eos.ncsu.edu	Critical Layer Thickness Determination of GaN/InGaN/GaN Double Heterostructures
TA-2.8	**11:30**	92	**R. Cingolani, G. Traetta, A. Passaseo, A. DiCarlo, P. Lugli, M. Berti, A. Drigo and H. Morkoç**	roberto.cingolani@unile.it	GaN quantum wells as mesoscopic capacitors: impact on electronic and excitonic states
TA-2HT	**11:50**		**11:50-12:20 PM: Open Discussion & Hot Topics; 12:20-2:00 PM: Break for Lunch, Omni Hotel**		
Session	**Time**	**Abstract #**	**Authors (Presenter's Name in Bold)**	**Contact e-mail**	**Title of Talk**
TP-1	**2:00**		***Electrical Characterization of III-Nitrides, Alloys & Modeling - Ted***		

			Moustakas, Jacques Pankove		
TP-1.1	**2:00**	99	**John Northrup**	northrup@parc.xerox.com	Theoretical studies of Indium on the surfaces of GaN
TP-1.2	**2:10**	4	**R. Schlesser, R. Collazo, and Z. Sitar**	raoul_schlesser@ncsu.edu	Hot electron transport measurements in ALN
TP-1.3	**2:20**	15	**D. Florescu, V. Asnin, F. Pollak, A. Jones, J. Ramer, M. Schurman, and I. Ferguson**	dflоresc@its.brooklyn.cuny.edu	Thermal Conductivity of Fully and Partially Coalesced Lateral Epitaxial Overgrown GaN/Sapphire (0001) Using a Scanning Thermal Microscope
TP-1.4	**2:30**	40	A. Hierro, D. Kwon, S. Ringel, M. Hansen, J. Speck, U. Mishra, and S. DenBaars	ringel@ee.eng.ohio-state.edu	Detection, properties and hydrogenation of deep levels in n-GaN
TP-1.5	**2:40**	81	**M.Misra, A. Sampath, and T.D. Moustakas**	tdm@bu.edu (T.D. Moustakas)	Vertical transport IN n-GaN films
TP-1.6	**2:50**	90	**A. Saxler, P. Debray, R. Perrin, S. Elhamri, W. C. Mitchel, C. R. Elsass, I. P. Smorchkova, B. Heying, E. Haus, P. Fini, J. P. Ibbetson, S. Keller, P. M. Petroff, S. P. DenBaars, U. K. Mishra and J. S. Speck**	adam.saxler@afrl.af.mil	Characterization of an AlGaN/GaN two-dimensional electron gas structure
TP-1.7	**3:00**	88	R. Singh, C.R. Eddy, Jr. and A. Aleksanyan	ceddy@bu.edu	Contacts to Plasma Processed GaN Surfaces
TP-1.8	**3:10**	68	**E. Bellotti, M. Goano, E. Ghillino, C. Garetto, M. Farahmand, K. F. Brennan and G. Ghione**	bellotti@zeppo.mirc.gatech.edu	Material Based Device Modeling of the Ternary III-Nitride Alloys
TP-1HT	**3:30**		**3:30-4:00 PM: Open Discussion & Hot Topics; 4:00-4:20 PM: Coffee Break**		
TP-2	**4:20**		***UV Sensors and Solar Blind UV Detectors - Hadis Morkoç, Jan Schetzina***		
TP-2.0	**4:20**	overview	**J. Schetzina**	jan_schetzina@ncsu.edu	Overview of UV Detectors
TP-2.1	**4:25**	7	**P. Schreiber, G. Smith, T. Dang, D. Agrestra, and J. Scheihing**	paul.schreiber@wpafb.af.mil	A Perspective of GaN/AlGaN Detector Development for UV Missile Warning Applications
TP-2.2	**4:35**	14	**M. Razeghi, P. Kung, F. Shahedipour, K. Mi, X. Zhang and V. Kumar**	razeghi@ece.nwu.edu	UV photodetectors

TP-2.3	**4:45**	21	T. Li, S. Wang, A. Beck, C. Collins, Bo Yang, R. D. Dupuis, J. C. Campbell, J. Carrano, M. Schurman and Ian Ferguson	jcc@mail.utexas.edu	AlxGa1-xN/GaN Photodiodes
TP-2.4	**4:55**	66	**P. Kozodoy, E. Tarsa, J. Ibbetson, and B. Keller**	kozodoy@nitres.com	Solar-Blind AlGaN-Based Photodiodes
TP-2.5	**5:05**	82	**M. Misra, E. Iliopoulos, D. Doppalapudi, H. M. Ng, T. D. Moustakas**	tdm@bu.edu (T.D. Moustakas)	Photoconductive detectors fabricated on GaN and AlxGa1-xN films grown by Molecular Beam Epitaxy
TP-2.6	**5:15**	83	D. J. H. Lambert, C. J. Eiting, M. M. Wong, U. Chowdhury, T. Li, B. Yang, C. J. Collins, J. C. Campbell, and R. D. Dupuis	dupuis@mail.utexas.edu	Performance of AlxGa1-xN/GaN pin Photodiodes Grown by MQCVD
TP-2.7	**5:25**	11	**J. C. Roberts, C. A. Parker, J. F. Muth, M. E. Aumer, S. F. LeBoeuf, S. M. Bedair, M. J. Reed**	jcrobert@eos.ncsu.edu	UV - visible InGaN photodetectors
TP-2.8	**5:35**	3	J. D. Brown, J. Matthews, J. Boney, P. Srinivasan, J. D. Benson, K. V. Dang, T. Nohava, Wei Yang, S. Krishnankutty, and J. F. Schetzina	jan_schetzina@ncsu.edu	UV digital cameras based on arrays of P-I-N nitride photodiodes
TP-2HT	**5:50**		**5:50-6:20 PM: Open Discussion & Hot Topics**		
Posters			**6:30-8:00 PM Poster Session (Appetizers and refreshments)**		
Session	**Time**	**Abstract #**	**Authors (Presenter's Name in Bold)**	**Contact e-mail**	**Title of Talk**
WA-1	**8:00**		***III-Nitride Electronic Devices - John Zolper***		
WA-1.1	**8:00**	104	**Yi Feng Wu**	yfwu@nitres.com	Progress and Challenges of GaN Based Microwave HEMT's and Amplifiers
WA-1.2	**8:10**	10	**L.F.Eastman, J. R. Shealy, W. Schaff, B. K. Ridley, J. Smart, E. Chumbes, V. Tilak, B. Green, H. Kim, and R. Dimitrov**	lfe@iiiv.tn.cornell.edu	Undoped Polarization-Induced (GaN)/AlGaN/GaN HEMT Technology

WA-1.3	**8:20**	93	**S. C. Binari, K. Ikossi-Anastasiou, W. Kruppa, J. A. Roussos, R. L. Henry, D. D. Koleske, and A. E. Wickenden**	binari@nrl.navy.mil	Traps in GaN HEMTs: Where are they and how do we find them?
WA-1.4	**8:30**	51	M. Micovic, N. Nguyen, W. Wong, P. Hashimoto, P. Janke, and C. Nguyen	cnnguyen@hrl.com	GaN-based FETs for low-noise amplifiers
WA-1.5	**8:40**	61	**X. Hu , M. Asif Khan, J. W. Yang, G. Simin, W. Knap, E. Frayssinet, P. Prystawko, M. Leszczynski, I. Grzegory, S. Porowski, R. Gaska, M. S. Shur**	hu@engr.sc.edu	GaN-AlGaN Heterostructure Field Effect Transistors Over Bulk GaN Substrates
WA-1.6	**8:50**	38	**I. Daumiller, E. Kohn, C. Kirchner, M. Seyboth, and M. Kamp**	daumiller@ebs.e-technik.uni-ulm.de	Demonstration of a GaN/ InGaN HFET with high breakdown behaviour
WA-1.7	**9:00**	62	**M. Asif Khan, X. Hu, G. Simin, J. Yang, R. Gaska, and M. S. Shur**	asif@engr.sc.edu	AlGaN/GaN Buried Channel Metal-Oxide-Semiconductor Heterostructure Field Effect Transistors on SiC Substrates
WA-1.8	**9:10**	71	M. S. Shur, R. Gaska, and Asif Khan	shurm@rpi.edu (M. S. Shur)	Modeling of AlGaInN/GaN Based Devices
WA-1.9	**9:20**	50	**P. Parikh, L. Mccarthy, J. Ibbetson, Y. Wu, U. Mishra, and B. Keller**	primit@nitres.com	AlGaN-GaN PNP HBT
WA-1HT	**9:40**		**9:40-10:00 AM: Open Discussion & Hot Topics; 10:00-10:20 AM: Coffee Break**		
WA-2	**10:20**		***Doping, Defects, and Properties of III-Nitrides and Alloys - Dave Look, Fred Schubert***		
WA-2.1	**10:20**	27	**A. E. Wickenden, D. D. Koleske, R. L. Henry, and M. E. Twigg**	wickende@estd.nrl.navy.mil	The contributions of microstructure and impurity compensation to highly resistive GaN
WA-2.2	**10:30**	80	**E. Glaser, G. Braga, W. Carlos, J. Freitas, R. Henry, D. Koleske, W. Moore, B. Shanabrook, and A. Wickenden**	glaser@bloch.nrl.navy.mil	Magnetic Resonance Studies of Mg-Doped GaN Epitaxial Layers Grown by OMCVD
WA-2.3	**10:40**	8	**A. K. Rice and K. J. Malloy**	arice@chtm.unm.edu	Microstructural Contributions to Hole Transport in p-type GaN:Mg
WA-2.4	**10:50**	44	E. L. Waldron, J. W. Graff, E. F. Schubert, A. Osinsky, W. J. Schaff and	EFSchubert@bu.edu	P-doped AlGaN/GaN superlattices: Physical properties and device applications

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WA-2.5	**11:00**	45	**D. C. Look, Z-Q. Fang, and L. Polenta**	david.look@wpafb.af.mil	Hall-Effect and DLTS Fingerprints of Defects in GaN
WA-2.6	**11:10**	46	**Z-Q. Fang, J. W. Hemsky, and D. C. Look, C. Z. Lu and H. Morkoç**	zhaoqiang.fang@wright.edu	Deep centers and irradiation effects in GaN p-i-n UV detectors
WA-2.7	**11:20**	65	**S. Goss, A. Young, L. Brillson, D. Look and R. Molnar**	goss.21@osu.edu, brillson.1@osu.edu	Variations in Defect Emission and Mobility with Layer Thickness of HVPE GaN
WA-2.8	**11:30**	86	I. Usov, B. Stoner and N. Parikh	nparikh@physics.unc.edu	p-type Doping of Epitaxial GaN by Impurity Complexes
WA-2.9	**11:40**	75	**L. Guido, P. Mitev, M. Gherasimova, B. Gaffey, M. Ahoujja and Y. K. Yeo**	louis.guido@vt.edu	Isoelectronic Doping of Gallium Nitride with Arsenic
WA-2.10	**11:50**	22	M. Mastro, O. Kryliuok, T. Anderson, A. Davydov, A. Shapiro, and V. Demin	davydov@nist.gov	The Thermal Stability of GaN
WA-2HT	**12:10**		**12:10-12:30 AM: Open Discussion & Hot Topics; Workshop Wrap Up 12:30-12:40 PM**		

Poster Presentation Schedule:

Session	Abstract #	Authors (Presenter's Name in Bold)	Contact e-mail	Title of Talk
TE-1		***Poster Session - Cole Litton, Asif Kahn***		
		Substrates and Crystal Growth		
TE-1.1	103	**Zlatco Sitar**	sitar@ncsu.edu	Growth of GaN and AlN single crystals
TE-1.2	72	**Jeffrey E. Nause**	jnause@cermetinc.com	Bulk Aluminum Nitride (AlN) Crystal Growth
TE-1.3	41	**J. E. Nause, D. Look, and H. Morkoç**	jnause@cermetinc.com	Zinc Oxide (ZnO) substrates
TE-1.4	25	**M. J. Callahan**	Michael.Callahan@hanscom.af.mil	Ammonothermal Growth of GaN and AlN Crystals
TE-1.5	37	**V. Dmitriev, D. Tsvetkov, and Yu. Melnik**	vladimir@tdii.com	AlGaN/GaN multi layer epi wafers fabricated by HVPE
TE-1.6	26	**D. Koleske, A. Wickenden, R. Henry, and M. Twigg**	koleske@estd.nrl.navy.mil	Dependence of GaN grain size and density on growth parameters
TE-1.7	17	**N. B. Singh, Chris Clarke and J. D. Adam**	narsingh_b_singh@md.northgrum.com	Evaluation of Transport Conditions during Vapor Growth of Bulk Crystals
		Electrical and Optical Characterization		
TE-1.8	19	**D. C. Look and C. E. Stutz**	david.look@wpafb.af.mil	Profiles of Electrical Properties in GaN
TE-1.9	54	**M. Asif Khan, J. Zhang, J. W. Yang, G. Simin, R. Gaska, and M. S. Shur**	asif@engr.sc.edu	Improved light emission from strain-tuned quaternary AlInGaN/InGaN Quantum Wells
TE-1.10	57	U. Ozgur, M. Bergmann, H. Casey, Jr., H. Everitt, and J. F. Muth	everitt@aro-emh1.army.mil	Refractive indices determined by waveguide measurements for epitaxial Al_xGa_{1-x}N films with x=0.0, 0.04, 0.07, 0.10, 0.20
TE-1.11	63	**A. Osinsky, L. Chernyak, L. Zhou, I. Adesida, J. W. Graff, and E. F. Schubert**	andrei@nzat.com	Characterization of Diodes Based on AlGaN/GaN Heterostructures and Superlattices for Bipolar Transistor Applications

TE-1.12	105	H. J. Im, Y. Ding and J. P. Pelz	pelz.2@osu.edu	Nanometer-scale studies of metal/GaN schottky contacts and GaN/AlGaN interfaces using Ballistic Electron Emission Microscopy (BEEM)
TE-1.13	106	S. Bradley, A. P. Young and L. J. Brillson	brillson.1@osu.edu	Influence of ALGaN Deep Level Defects on AlGaN/GaN 2DEG Carrier Confinement
		Devices		
TE-1.14	100	**Rich Molnar**	rmolnar@ll.mit.edu	HVPE grown GaN avalanche photodiodes
TE-1.15	77	D. J. H. Lambert, B. Shelton, T. Zhu, C. Eiting, M. Wong, U. Chowdhury, R. D. Dupuis, J. J. Huang and M. Feng	dupuis@mail.utexas.edu	Performance of AlxGa1-xN/GaN Heterostructure Bipolar Transistors Grown by MOCVD
TE-1.16	70	**S.L. Rumyantsevand, M. S. Shur, R. Gaska, Asif Khan, G. Simin, J. Yang, N. Zhang, S. DenBaars, and U. K. Mishra**	shurm@rpi.edu (M. S. Shur)	Transient Processes in AlGaN/GaN Heterostructure Field Effect Transistors
TE-1.17	101	E. Alekseev, P. Nguyen-Tan, D. Pavlidis, N. X. Nguyen, C. Nguyen, D.E. Grider	pavlidis@umich.edu	Currrent Injection Characterization of AlGaN/GaN MODFETs
TE-1.18	102	S. Hubbard, E. Alekseev, D. Pavlidis, T. Detchprohm, H. Amano and I. Akasaki	pavlidis@umich.edu	Electrical Characteristics of GaN Based PIN Diodes

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