MIT/MTL GaN Energy Initiative

Microsystems Technology Laboratories

MIT MTL Gallium Nitride Kickoff Meeting 2012

By jbaylon
February 13, 2012

The members of the MIT/MTL GaN Energy Initiative are cordially invited to attend the forthcoming Program's kick off meeting. The meeting will be held at the Massachusetts Institute of Technology (MIT) on April 24th, 2012.

Date: Tuesday, April 24, 2012

Venue: Massachusetts Institute of Technology
50 Vassar Street, Building 34, Room 401 (for directions, please click here)

Registration

Online registration is required to attend the meeting. You can register here. The registration will be open until **April 19th, 2012**, however early registration is strongly encouraged to help the organization of the workshop.

Hotel Information

Hotels in Cambridge are expensive, so it is recommended that you make your reservation as soon as possible. A few options located close to MIT are given below:

Marriott Cambridge Boston: Currently available is the Concierge level rooms at the MIT rate $266. Guests can book online at the discounted rate. **Rooms are almost sold out so book your room as soon as possible.**

www.marriott.com/boscb (Mention Corp/promotional code: MT2)

The Kendall Hotel at the Engine 7 Firehouse: A block of rooms is being held at the special rate $294 per night (April 22nd) -Special Government rates is available on a first come basis. Total cost includes a full American Breakfast Buffet daily, high speed Internet access (wired and WiFi), pass to nearby fitness center, a hosted wine hour (Mon-Thurs) and local calls.

This hotel is near the MIT campus and less than 10 minutes walk from the Meeting venue. Please use the following hotel link to make your room reservation: Kendall Hotel at the Engine 7 Firehouse. For reservations, go to www.kendallhotel.com – book a room – reservation wizard – type in dates – under promotional code type in MTL. **Space is limited so reserve a room today.**

To make a reservation by telephone call 1(866)556-1300 or 1(617)577-1300 and use the reservation code: MTL.

Additional options for hotel accommodation in the Boston/Cambridge area can be found here

Map

The best way to get from Boston Logan International Airport (BOS) to MIT and the Kendall Hotel is by taxi. The ride takes approximately 20 min. and costs ~$25-40.
Parking in Boston and Cambridge is very limited and expensive.

Link to campus map with location of Building 34

How to walk from Kendall hotel to meeting location.

How to walk from Marriott Cambridge Boston to meeting location

Agenda

MIT GaN Energy Initiative Meeting Final Agenda

MIT MTL Gallium Nitride will host a dinner starting at 6 pm at Legal Seafoods- Kendall Square in Cambridge, MA. Please click here for exact location. **Please note: The dinner is restricted to the Program's PI's and Industrial and Government members.

Webex

You can find information on how to join the meeting through Webex here (the link requires access to the member-only section of this website).

Presentations

After the meeting, the members of the Initiative will be able to find all presentations here.

Questions?

For any questions regarding this review, please contact Mr. Joseph Baylon (jbaylon@mit.edu).

Summary of the 2012 MTL MIT GaN Energy Initiative Kick-Off Meeting

By jbaylon
May 1, 2012

 On April 24th, 2012, MIT's Microsystems Technology Laboratories (MIT) hosted the kick-off meeting of the MIT/MTL GaN Energy Initiative. With more than 60 registered participants, the meeting was a tremendous success due to the collaborative efforts from our industrial members, MIT faculty, staff, and students. The conference covered the various research themes of the GaN Energy Initiative , including GaN Transistor Technology, GaN Nanowires for solid state lighting, GaN Device Reliability, Thermal issues of GaN technology, as well as circuit and system level demonstrators. The slides discussed during the meeting are available for the members of the Initiative here.

If you were unable to attend this meeting and were interested in viewing the presentations, please inquire how to join the GaN Energy Initiative by clicking here.

Summary of the 2012 research projects funded by the MIT GaN Energy Initiative

By jbaylon
June 26, 2012

Please click here for a summary of the research projects funded by the MIT GaN Energy during 2012.

GaN Seminar Series

By tpalacios
June 28, 2012

Starting in July 2012, the MIT GaN Energy Initiative will host a seminar series to highlight the GaN research going on at MIT. The tentative schedule for the seminars is shown below:

- July 20th, 2012 at 12pm (EST)… **Tomas Palacios**: *Recent Progress on GaN Transistor Technology*
- August 17th, 2012 at 12pm (EST)… **David Perreault**: *Load Modulation and Outphasing in Switched-Mode Inverters and Power Amplifiers*
- September 21st, 2012 at 12pm (EST) … **Xiang Zhou; Jordan Paul Chesin (Gradecak's group)**: *GaN nanowires for Solid State Lighting*
- October 26th, 2012 at 12pm (EST)… **Kevin R. Bagnall (Wang's group)**: *Physical insights into thermal management for GaN electronics*
- November 16th, 2012 at 12pm (EST) … **Ujwal Radhakrishna (Antoniadis's Group)**: MIT Unified VS GaNFET (MVSG) Model: A Current and Charge Model for GaN HEMTs
- December 21st, 2012 at 12pm (EST)… **Saurav Bandyopadhyay (Chandrakasan's group)**: *Solid State Lighting Using GaN FETs*
- January 31st, 2013 at 12pm (EST)… **Jesus del Alamo**: *Characterization of Breakdown Voltage in GaN FETs*

The seminars will be broadcasted through webex and posted in the password-protected section of this website.

If you would like more information about the seminar series or you would like to propose new topics, please contact us here.

Updated list of GaN publications

By tpalacios
July 4, 2012

The updated list of MIT's GaN-related publications can be found here.

Please note that only the members of the MIT GaN Energy Initiative have access to this page. If you would like more information regarding how to become a member, please send an an email here.

GIGA Review Meeting – Thursday, August 23, 2012

By jbaylon
August 14, 2012

On August 23rd, 2012, MIT will host a review of the DOE-sponsored GaN Initiative for Grid Applications (GIGA) program. The members of the GIGA program and DOE National Laboratories are invited to attend the meeting.

Date: Thursday, August 23, 2012

Venue

Massachusetts Institute of Technology
50 Vassar Street, Building 34, Room 401 B (for directions, please click here)

Registration

The registration is now closed.

Hotel Information

This hotel is near the MIT campus and less than 10 minutes walk from the Meeting venue. Please use the following hotel link to make your room reservation: Kendall Hotel at the Engine 7 Firehouse. For reservations, go to www.kendallhotel.com – book a room – reservation wizard – type in dates – **Space is limited so reserve a room today.**

To make a reservation by telephone call 1(866)556-1300 or 1(617)577-1300 and use the reservation code: MIT (for government employees only).

You can find additional options for hotel accommodation in the Boston/Cambridge area here

Map

The best way to get from Boston Logan International Airport (BOS) to MIT and the Kendall Hotel is by taxi. The ride takes approximately 20 min. and costs ~$25-40.
Parking in Boston and Cambridge is very limited and expensive.

Link to campus map with location of Building 34

How to walk from Kendall hotel to meeting location.

Agenda

GaN Initiative for Grid Applications Agenda

(The following presentations below are password protected, please contact Joseph Baylon at jbaylon@mit.edu regarding access.)

8:50-9:00	Tomás Palacios (MIT) and Michael Soboroff (DOE): *Welcome and Opening Remarks*
9:00-9:15	Douglas Carlson (M/A-COM): *Program Overview/Goals- Team Perspective*
9:15-10:00	Richard Molnar (MIT-LL): *Nitride Materials Development for Power Electronics*
10:15-10:45	Timothy Boles (M/A-COM): Manufacturing of GaN High Voltage HEMTs
10:45-11:30	Tomás Palacios (MIT): Advanced Device Technology
11:30-12:00	Robert J. Kaplar (Sandia National Lab.): Collaboration with GIGA program on GaN Device Characterization and Reliability
13:00-13:30	George W. Turner (MIT-LL): Concluding Remarks & Program Updates

GIGA program and DOE National Laboratories will host a dinner on **Wednesday night, August 22nd 2012** starting at 6 pm at Legal Seafoods-Kendall Square in Cambridge, MA. Please click here for exact location. **Please note: The dinner is restricted to the DOE National Laboratories and GIGA program members.

Presentations

After the meeting, you will be able to find all presentations here.

Questions?

For any questions regarding this review, please contact Mr. Joseph Baylon (jbaylon@mit.edu).

Friday, Nov. 30th MIT/MTL GaN Energy Initiative Semi-Annual Review

By jbaylon
November 28, 2012

Dear MTL/MIT faculty, students and industrial members:

You are cordially invited to attend the semi-annual MIT/MTL GaN Energy Initiative seminar on **Friday, November 30th at 9:00 am(EST)**. Registration is not required. This webinar will discuss and highlight upcoming GaN related research plus its progress by MIT's faculty and their students. Please click here for the FINAL agenda of our proposed speakers, so if you have any feedback or questions, please let me know.

Please note, attendees are welcome to join the meeting onsite(bldg. 34-401-B, exact directions- here) or follow the meeting via WebEx. This webinar is reserved for MIT faculty, their students and the GaN Industry members.

Thank you for your involvement, participation, and the success of the GaN Energy Initiative. If you have any questions or would like access to the WebEx information, please contact me via email at jbaylon@mit.edu.

Friday, November 30th: Semi-Annual GaN Energy Review

By jbaylon
December 3, 2012

2012 MIT MTL GaN Energy Initiative

Semi-Annual Review via WebEx

50 Vassar St., Bldg. 34, Grier room 401-B (4th floor)

Cambridge, MA

Friday, November 30, 2012

AGENDA

NOTE: Please remember that many of the results discussed during the review meeting are still unpublished. Therefore, please do not distribute them. Thank you.

Click the links below to view PDF presentations.

9:00-9:40 am *Prof. Tomás Palacios:* Introduction and GaN Device Technology

9:40-10:00 am *Prof. Dimitri Antoniadis:* Development of Compact Model for AlGaN/GaN HEMTs for RF and Power Applications

10:00-10:20am *Prof. Silvija Gradečak:* GaN Nanowires for Solid State Lighting

10:20-10:30am *Break*

10:35-10:55am *Prof. Anantha Chandrakasan:* GaN Power Conversions for Solid State Lighting Applications

10:55-11:15am *Prof. Evelyn Wang:* Thermal Issues of GaN Electronics

11:15-11:35am *Prof. Jesús del Alamo:* GaN Device Reliability

11:40-12:00pm *Prof. David Perreault:* GaN Power Circuits and RF Amplifiers

To View the entire presentation: Please click video below:

Summary of MIT/MTL GaN Energy Initiative Seminar Semi-Annual Review (Friday, Nov. 30, 2012)

By jbaylon
December 3, 2012

On Friday, November 30th, 2012, MIT's Microsystems Technology Laboratories (MIT) hosted the semi-annual review meeting of the MIT/MTL GaN Energy Initiative. The conference covered the various research themes of the GaN Energy Initiative , including GaN Transistor Technology, GaN Nanowires for solid state lighting, GaN Device Reliability, Thermal issues of GaN technology, as well as circuit and system level demonstrators.

The slides discussed during the meeting are available for the members of the Initiative here.

MIT MTL GaN Energy Initiative Review Meeting (Wednesday, March 27, 2013)

By jbaylon
February 25, 2013

Members of the MIT/MTL GaN Energy Initiative are cordially invited to attend the 2013 Annual Program's Review meeting. The meeting will be held at the Massachusetts Institute of Technology (MIT) on Wednesday, March 27, 2013.

Date: **Wednesday, March 27, 2013**

Time: 9:00am to 4:00pm

Venue: Massachusetts Institute of Technology (MIT)
50 Vassar Street, Building 34, Room 401 (for directions, please click here)

Registration

Registration is closed

***MIT MTL GaN Energy Initiative will host a dinner starting at 6:00 pm on Wednesday (3/27) at the Catalyst Restaurant -(300 Technology Square, Cambridge, MA) Click here for restaurant details. **Please note: This dinner is reserved for program's principal investigators, industrial and government members.

Agenda

Click below to see the list of presentation and speakers:

MIT GaN Center Review Agenda

Hotel Information

Hotels in Cambridge are expensive, so it is recommended that you make your reservation as soon as possible. A few options located close to MIT are given below:

Cambridge Residence Inn by Marriott: To reserve a room with one **Queen** bed at a rate of $199 a night, please click on the link: Cambridge Residence Inn

To make a reservation by telephone call 1(888) 236 2427

The Kendall Hotel at the Engine 7 Firehouse: Special government rates is available on a first come basis. Total cost includes a full American Breakfast Buffet daily, high speed Internet access (wired and WiFi), pass to nearby fitness center, a hosted wine hour (Mon-Thurs) and local calls.

This hotel is near the MIT campus and less than 10 minutes walk from the Meeting venue. Please use the following hotel link to make your room reservation: Kendall Hotel at the Engine 7 Firehouse. For reservations, go to www.kendallhotel.com – **Space is limited so reserve a room today.**

To make a reservation by telephone call 1(866)556-1300 or 1(617)577-1300

Additional options for hotel accommodation in the Boston/Cambridge area can be found here

Map

The best way to get from Boston Logan International Airport (BOS) to MIT is by taxi. The ride takes approximately 20 min. and costs ~$25-40. Parking in Boston and Cambridge is very limited and expensive. **(Click links below for exact directions)**

Link to campus map with location of Building 34

How to walk from Kendall hotel to meeting location.

How to walk from Cambridge Residence Inn to meeting location

Joining the meeting via Webex

To join the meeting through WebEx on Wednesday, March 27, 2013, please click here. (Please note, the link requires access to the member-only section of this website).

Presentations

All presentations of the annual review will be available for all members of the GaN Energy Initiative after the meeting, please contact Joseph Baylon for details.

Questions?

For any questions regarding the annual review, please contact Joseph Baylon (jbaylon@mit.edu).

Summary of the 2013 MIT/MTL GaN Energy Review Meeting (Wednesday, March 27, 2013)

By jbaylon
April 8, 2013

MIT MTL GaN Energy

Review Meeting

50 Vassar St., Bldg. 34, Room 401 (4th floor)

Cambridge, MA Wednesday, March 27, 2013

AGENDA

NOTE: Please remember that many of the results discussed during the review meeting are still unpublished. Therefore, please do not distribute them. Thank you.

9:00-9:30 Registration and Breakfast

9:30-9:40 Prof. Tomás Palacios: Welcoming Remarks: Introduction

9:40-10:05 Prof. Dimitri Antoniadis: High Voltage GaN HEMT Modeling013

10:10-10:55 Prof. Tomás Palacios: Recent Progress on GaN Transistor Technology

11:00-11:15 Coffee break

11:15-11:40 Prof. Hae-Seung Lee: High Voltage GaN Front End and A/D Converter

11:40-12:00 Dr. Richard Molnar (Lincoln Laboratories): III-N Device Optimization for Power Electronics

12:00-1:00 Lunch

13:00-13:20 Saurav Bandyopadhyah (Prof. Chandrakasan's Group): GaN Power Conversions for Solid State Lighting Applications

13:20-13:40 Prof. Evelyn Wang: Thermal Characterization of GaN-based Electronics

13:40-14:00 Mr. Eric Jones(Prof. Gradeĉak Group): Stress characterization and device performance in GaN HEMTs

14:00-14:20 Prof. David Perreault: Research on VHF GaN Power Converters

14:20-14:40 Dr. Taylor Barton: A New Power-Combining Network for High-Efficiency Switched-Mode GaN Power Amplification

Video of the entire presentation is available below. (Please note, Mr. Saurav Bandyopadhyay talk contains some audio difficulty, so please fast forward to hear the rest of his talk.)

2013 MTL/MIT GaN Energy Initiative Seminar

2013 Summary of the MIT/MTL GaN Energy Review (Wednesday, March 27, 2013)

By jbaylon
April 8, 2013

On Wednesday, March 27, 2013, MIT's Microsystems Technology Laboratories (MIT) hosted the annual review meeting of the MIT/MTL GaN Energy Initiative. The conference covered various research themes from Recent Progress on GaN Transistor Technology, High Voltage GaN HEMT Modeling, Research on VHF GaN Power Converters and much more.

The slides discussed during the meeting are available for the members of the Initiative here. (Please note, you must have a log in and password to view this page)

MIT/MTL GaN Energy Review Meeting (April 11th, 2013)

By jbaylon
May 1, 2013

As you know, we held the Annual review of the GaN Energy Initiative on March 27th. Due to schedule conflicts, Prof. Dana Weinstein and Prof. Jesus del Alamo were not able to present their 2013 projects at the meeting.They have however agreed to present their work this Thursday, April 11, 2013 at 12:00pm (EDT). If you are available, it would be great if you could please attend their WebEx presentations and provide them feedback on their 2013 projects. The first talk will be presented by Prof. Dana Weinstein entitled "**RF MEMS resonators in GaN MMIC technology**", then Prof. Jesús del Alamo will talk about his proposed work on the "**Characterization of Breakdown Voltage in GaN FETs**".

Prof. Dana Weinstein

Talk title: **RF MEMS resonators in GaN MMIC technology**

Time: 12pm-12:30pm (EDT)

Click here for Prof. Weinstein slides

Below is the presentation video.

Prof. Jesús del Alamo

Talk title: **Characterization of Breakdown Voltage in GaN FETs**

Time: 12:30-1:00pm (EDT)

Click here for Prof. del Alamo and student Alex Guo slides

Below is the presentation video

MIT/MTL Annual GaN Energy Review Meeting (Thursday, April 11, 2013)

By jbaylon
May 1, 2013

On Thursday, April 11th, MIT's Microsystems Technology Laboratories (MIT) hosted a second part of the annual review meeting of the MIT/MTL GaN Energy Initiative via WebEx. Due to schedule conflicts, Prof. Dana Weinstein and Prof. Jesus del Alamo were not able to present their 2013 projects at the review meeting on Wednesday, March 27, 2013.

The slides discussed during the meeting are available for the members of the Initiative here. *(**Please note, you must have a log in and password to view this page)*

Research Summary 2013

By jbaylon
May 8, 2013

Dear MIT/MTL GaN Energy Initiative Members,

Please click here for a summary of the research projects funded by the MIT/MTL GaN Energy during 2013.

To view the 2013 MIT/MTL GaN Energy Initiative WebEx seminars, please click here to be re-directed.

TI and MIT Collaborate

By jbaylon
May 28, 2013

Imagine a charger that powers your laptop – but it's the size of a cell phone charger. It's smaller and lighter, but still packs the same power punch. This is just one way that new material being researched today could save energy – and impact your life.

TI has been working with students and professors at the Massachusetts Institute of Technology (MIT) on the use of the material gallium nitride (GaN) in powering devices in homes and offices, to name a few areas of use. "Everyone hopes it's the next new material for power devices," says Dave Freeman, a TI Fellow and chief technologist for power supply solutions in analog. "Right now, it has some attractive features, but there are some challenges with it. (Read more)

MIT/MTL WebEx June 2013 Seminar

By jbaylon
June 30, 2013

This month's WebEx seminar on GaN materials, devices and circuits was scheduled for Friday, June 21, 2013 at 12:00pm (EDT). This seminar series highlights the MIT faculty and their students' research and its progress. This is sponsored by the MIT/MTL GaN Energy Initiative. This seminar was presented by Mr. Omair Saadat and Mr. Feng Gao under Prof. Tomás Palacios' group(website). (***Member login is required to view this link)

MIT/MTL WebEx July 2013 Seminar

By jbaylon
July 30, 2013

This month's WebEx seminar on GaN materials, devices and circuits was scheduled last Friday, July 26, 2013 at 12:00pm (EDT). This seminar series highlights the MIT faculty and their students' research and its progress. This event is sponsored by the MIT/MTL GaN Energy Initiative. This seminar was presented at MIT by Mr. Kevin Bagnall under Prof. Evelyn Wang's group(website). (***Member login is required to view this link)

Degradation of GaN HEMTs under High-Power and High-Temperature Conditions

By jbaylon
August 26, 2013

Click below for the video:

New Technologies to Increase the Stability and Reliability of GaN Transistors

By jbaylon
August 26, 2013

Seminar by Mr. Omair Saadat & Feng Gao under Prof. Tomás Palacios (MIT)

Click below for the video:

Understanding and predicting thermal transport in high-power GaN electronics

By jbaylon
August 26, 2013

Seminar by Kevin Bagnall, under Prof. Evelyn Wang's group (MIT)

Click below for video:

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Four-Way Outphasing and Power-Combining Networks for GaN Microwave Power Amplifiers

By jbaylon
August 26, 2013

Seminar by Dr. Taylor Barton (MIT)

“Four-Way Outphasing and Power-Combining Networks for GaN Microwave Power Amplifiers”

Click below for video:

By jbaylon
October 25, 2013

Dr. Akira Uedono is a Professor in Division of Applied Physics, Faculty of Pure and Applied Science, University of Tsukuba, Japan. He earned his Ph.D. in material sciences at the Institute of Materials Science, University of Tsukuba, 1989. He has been research associate at Yokohama City University and University of Tokyo. His research is mainly focused on defects and atomic scale disorder in solids. His work aims at the development of positron annihilation technique for material characterization and its application for semiconductor technology and other fields.

Abstract:

A positron is an antiparticle of an electron. When a positron is implanted into condensed matter, it annihilates with an electron and emits two g quanta according to Einstein's equation $E=mc2$. It is no longer a toy for high-energy physicists but a sophisticated tool for material scientists now. Positron annihilation is a non-destructive tool for investigating vacancy-type defects and open spaces in materials. With this technique, detectable defects are monovacancy to open pore (<100 nm3). The detection efficiency is high (>1015 cm-3 for a monovacancy), and there is no restriction of sample temperature or conductivity. Using a monoenergetic positron beam, depth distributions of defects in the subsurface region can be determined. Native and process-induced defects in group-III nitride semiconductors have been investigated using this method, and the results show that positrons are a powerful probe for studying cation vacancies and their complexes. In the present study, we report native defects and their introduction mechanism in InGaN . Applications of the positron annihilation spectroscopy to latest Si-technology related materials, such as ultra-shallow doped Si, low-k materials, electroplated Cu, will be also reviewed .

1. A. Uedono, S. Ishibashi N. Oshima, and, R. Suzuki, Jpn. J. Appl. Phys. **52**, 08JJ02 (2013).
2. A. Uedono, T. Tsutsui, T. Watanabe, S. Kimura, Y. Zhang, M. Lozac'h, L. W. Sang, S. Ishibashi, and M. Sumiya, J. Appl. Phys. **113**, 123502 (2013).
3. A. Uedono, T. Moriya, T. Tsutsui, S. Kimura, N. Oshima, R. Suzuki, S. Ishibashi, H. Matsui, M. Narushima, Y. Ishikawa, M. Graf, and K. Yamashita, Jpn. J. Appl. Phys. **51**, 111801 (2012).
4. A. Uedono, P. Verdonck, A. Delabie, J. Swerts, T. Witters, T. Conard, M. R. Baklanov, S. Van Elshocht, N. Oshima, and R. Suzuki, Jpn. Appl. Phys. **52**, 106501 (2013).
5. A. Uedono, T. Kirimura, C. J. Wilson, K. Croes, S. Demuynck, Z. Tőkei, N. Oshima, and R. Suzuki, J. Appl. Phys. **114**, 074510 (2013).

MIT-MTL GaN Energy Initiative WebEx Seminar September 20, 2013

By jbaylon
November 6, 2013

Seminar by Dr. Rich Molnar (MIT)

“Nitride Materials Development for Power Electronics”

Click below for video:

MIT-MTL GaN Energy Initiative WebEx Seminar October 25, 2013

By jbaylon
November 6, 2013

Seminar by Mr. Ujwal Radhakrishna under Professor Dimitri Antoniadis's group MIT

"Improvements on MIT Unified VS GaNFET (MVSG) Model to suit RF and switching applications"

Click below for video:

MIT-MTL GaN Energy Initiative WebEx Seminar December 20, 2013

By jbaylon
December 23, 2013

Seminars by Prof. Dana Weinstein and Prof. Hae-Seung (Harry) Lee's group at MIT

"GaN RF MEMS resonators" and "Gallium Nitride: Emerging Applications and Architectures"

Click below for video:

MIT/MTL GaN Energy Initiative (August 2013 WebEx) Seminar

By jbaylon
December 23, 2013

This month's WebEx seminar on GaN materials, devices and circuits was scheduled last Friday, August 23, 2013 at 12:00pm (EDT). This seminar series highlights the MIT faculty and their students' research and its progress. This event is sponsored by the MIT/MTL GaN Energy Initiative. This seminar was presented at MIT by Dr. Taylor Barton. (***Member login is required to view this link)

MIT/MTL GaN Energy Initiative (September 2013 WebEx) Seminar

By jbaylon
December 23, 2013

This month's WebEx seminar on GaN materials, devices and circuits was scheduled last Friday, September 27, 2013 at 12:00pm (EDT). This seminar series highlights the MIT faculty and their students' research and its progress. This event is sponsored by the MIT/MTL GaN Energy Initiative. This seminar was presented at MIT- Lincoln Laboratory by Dr. Richard Molnar. (***Member login is required to view this link)

MIT/MTL GaN Energy Initiative (October 2013 WebEx) Seminar

By jbaylon
December 23, 2013

This month's WebEx seminar on GaN materials, devices and circuits was scheduled last Friday, October 25, 2013 at 12:00pm (EDT). This seminar series highlights the MIT faculty and their students' research and its progress. This event is sponsored by the MIT/MTL GaN Energy Initiative. This seminar was presented at MIT by Mr. Ujwal Radhakrishna under Professor Dimitri Antoniadis's group. (***Member login is required to view this link)

MIT/MTL GaN Energy Initiative (December 2013 WebEx) Seminar

By jbaylon
December 23, 2013

This month's WebEx seminar on GaN materials, devices and circuits was scheduled last Friday, December 20, 2013 at 12:00pm (EST). This seminar series highlights the MIT faculty and their students' research and its progress. This event is sponsored by the MIT/MTL GaN Energy Initiative. This seminar was presented at MIT in two parts, first by Prof. Dana Weinstein and second by Mr. Sushmit Goswami & Ms. Xi Yang under Prof. Hae-Seung(Harry) Lee's group. (***Member login is required to view this link)

Spanish Royal Academy of Engineering Award

By jbaylon
January 10, 2014

The Spanish Royal Academy of Engineering has awarded the “Agustin de Betancourt” award to Prof. Tomás Palacios. This award, the most prestigious given in Spain to an engineer less than 36 years old, recognizes Prof. Palacios’ work on nanotechnologies applied to high frequency electronic devices based on GaN and graphene. The award was presented by the Academy’s President, Prof. Elias Fereres, on November 26, 2013.

Prof. Palacios poses with Prof. Elias Fereres (left), President of the Spanish Royal Academy of Engineering, and Mr. Rafael del Pino (right), member of the MIT Corporation and CEO of Ferrovial.

Congratulations Tomás for yet another award in 2013!

MIT/MTL GaN Energy Initiative (February 2014 WebEx) Seminar

By jbaylon
February 19, 2014

This month's WebEx seminar on GaN materials, devices and circuits was scheduled last Friday, February 14th, 2014 at 12:00pm (EST). This seminar series highlights the MIT faculty and their students' research and its progress. This event is sponsored by the MIT/MTL GaN Energy Initiative. This seminar was presented at MIT in two parts, first by Prof. David Perreault and secondly by Mr. Eric Jones under Silvija Gradečak's group.
(***Member login is required to view this link)

MIT-MTL GaN Energy Initiative WebEx Seminar February 14, 2014

By jbaylon
February 19, 2014

Seminars by Prof. David Perreault and Prof. Silvija Gradečak's Ph.D. student, Mr. Eric Jones at MIT on Friday, February 14, 2013

"A Power Conversion Architecture for Single-Phase Grid Interface with GaN Devices Operating at High Frequency" and "Nanoscale quantification of strain in InAlN nanoribbon high electron mobility transistors"

Click below for video:

Donghyun Jin Thesis Defense: Dynamic ON-resistance in High-Voltage GaN Field-Effect-Transistors

By jbaylon
March 12, 2014

Title: Dynamic ON-resistance in High-Voltage GaN Field-Effect-Transistors
Speaker: Donghyun Jin
Date: Wednesday, Mar 12, 2014
Thesis committee: Prof. Jesús del Alamo (supervisor) Prof. David Perreault Prof. Tomas Palacios

Abstract:

Click here for PDF slides

Recently, the development of energy efficient electrical power management systems has received considerable interest due to its potential to realize significant energy savings for the world. With current Si-based power electronics system being matured, GaN Field-Effect-Transistors have emerged as a disruptive technology with great potential that arises from the outstanding material properties of GaN. However, in spite of great progress in GaN device fabrication, electrical reliability and a number of unique anomalies of GaN remain key challenges that prevent the wide deployment of this technology. In particular, the dynamic ON-resistance (R_{ON}), in which the R_{ON} of the transistor remains high for a certain period of time after a high-

voltage OFF-ON switching event, is a critical concern. This phenomenon greatly affects the efficiency of electrical power management circuits based on GaN power transistors. This thesis investigates in depth this important issue. Firstly, we have developed a new dynamic R_{ON} measurement methodology which can observe dynamic R_{ON} transients after OFF-to-ON switching events over many decades in time. We have experimentally demonstrated this technique on GaN-on-SiC high-voltage HEMTs (High-Electron-Mobility-Transistors). The possible origin of the mechanisms responsible for dynamic R_{ON} in these devices has been postulated. Through our new technique, the impact of high-power stress on dynamic R_{ON} has been investigated as well. The results emphasize the importance of studying dynamic R_{ON} characteristics over very short time scale when conducting reliability studies of GaN transistors.

Secondly, high-voltage GaN-on-Si MIS (Metal-Insulator-Semiconductor) HEMTs designed for > 600 V switching operation have been investigated. Excessive electron trapping leading to total current collapse has been observed. We have carried out an extensive characterization of this phenomenon and we have proposed “Zener trapping” as the responsible mechanism. In this view, electron trapping takes place inside the AlGaN/GaN heterostructure through a tunneling process under high-electric-field. The understanding derived here suggests that this effect can be mitigated through attention to defect control during epitaxial growth and appropriate design of the field plate structure of the device.

Our findings in this thesis provide a path to achieve high performance GaN power transistors with minimum dynamic R_{ON} effects.

March 12, 2014: MIT-MTL GaN Energy Initiative Special Seminar (Donghyun Jin)

By jbaylon
March 13, 2014

You must login to view this page.

Research Funding 2014

By jbaylon
March 18, 2014

Industrial Members of the MTL GaN Energy Initiative,

First of all, I would like to thank you for your feedback and help during the last few weeks in identifying relevant research topics for the GaN Energy Initiative. After combining the research priorities with the available resources, we have selected 12 projects for funding during 2014.

You can find a summary of the selected projects listed here

The monthly WebEx seminars will begin again in the near future, the start date is yet to be determined.

By now, all the PI's have already received the funding and are working hard on the projects. We will start giving you updates on their progress very soon.

In the next few days, we will have a summary of changes that we are implementing in the the MTL GaN Energy Initiative this year. We are designing a wide variety of new events to make the program even more useful.

Thank you again for all your continuous support to the MTL GaN Energy Initiative. Everyone at MTL is looking forward to keep working with you to make GaN electronics a big success.

Prof. Tomas Palacios

2014 MIT-MTL GaN Energy Initiative Annual Review WebEx Information

By jbaylon
May 9, 2014

MIT/MTL GaN Energy Initiative invites you to attend this online meeting.
Topic: MIT/MTL GaN Energy Initiative Annual Review
Date: **Tuesday, June 10, 2014**
Time: 8:45 am, Eastern Daylight Time (New York, GMT-04:00)
Meeting Number: **647 932 328**
Meeting Password: **GaN06102014**

To join the online meeting (Now from mobile devices!)

---

1. Go to **MIT/MTL GaN Energy Initiative Annual Review**
2. If requested, enter your name and email address.
3. If a password is required, enter the meeting password: GaN06102014
4. Click “Join”.

To view in other time zones or languages, please click the link:
https://mit.webex.com/mit/j.php?MTID=m360295ff1a134663513f4c2a4bbe17fc

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To join the audio conference only

To receive a call back, provide your phone number when you join the meeting, or call the number below and enter the access code.
US Toll Number: +1-617-324-0000

Access code:647 932 328

For assistance

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1. Go to https://mit.webex.com/mit/mc
2. On the left navigation bar, click “Support”.

You can contact me at:
jbaylon@mit.edu
1-617-2530987

To add this meeting to your calendar program (for example Microsoft Outlook), click this link:
https://mit.webex.com/mit/j.php?MTID=m92f25f7e7de68baca61aa3037423bcf6

The playback of UCF (Universal Communications Format) rich media files requires appropriate players. To view this type of rich media files in the meeting, please check whether you have the players installed on your computer by going to https://mit.webex.com/mit/systemdiagnosis.php.

http://www.mit.edu

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IMPORTANT NOTICE: This WebEx service includes a feature that allows audio and any documents and other materials exchanged or viewed during the session to be recorded. By joining this session, you automatically consent to such recordings. If you do not consent to the recording, discuss your concerns with the meeting host prior to the start of the recording or do not join the session. Please note that any such recordings may be subject to discovery in the event of litigation.

2014 MIT-MTL GaN Energy Initiative Online Registration

By jbaylon
May 9, 2014

Please select a valid form

Prof. Suski (UNIPRESS, Warsaw, Poland) May 12, 2014

By jbaylon
May 13, 2014

InGaN/GaN Quantum-Well based violet-blue light emitters on bulk gallium nitride substrates

Speaker: Professor Tadeusz Suski
Monday, May 12, 2014
Jackson Room (38-466)
12:00pm to 1:00pm

Abstract: In my talk, I will concentrate on the growth of bulk GaN crystals that are used as perfect substrates for nitride based emitters. The successful use of the Group III-nitrides (GaN-InN-AlN and their alloys) in manifold optical and electric applications has stimulated wide range of research on this semiconductor family. Secondly, I will discuss a few examples of applications of nitride quantum structures in the field of light emitters grown on such bulk substrates will be given. They include in particular violet-blue Laser Diodes and Super Luminescent Diodes (SLDs).

Speaker's Profile: Prof. Tadeusz Suski graduated in solid state electronics at the Technical University Wroclaw. He is currently a Full Professor at "Unipress" and a head of the Semiconductor Laboratory at this Institute. He is the coauthor of 6 chapters in important monographies, editor of two volumes of High Pressure in Semiconductor Physics in the Series of Semiconductors and Semimetals, Vol. 54 and Vol 55, eds. T. Suski and W. Paul (Academic Press). During last 12 years he has been involved in studies of Group-III nitrides consisting of their basic properties and optoelectronic applications. He is a member of advisory committees of several international conferences (e.g., International Conference on Nitride Semiconductors, Int. Symposium on Blue Light Emitting Diodes, Int. Conference on High Pressure in Semiconductor Physics and many other).

Dr. Puneet Srivastava (MIT) May 28, 2014 Seminar

By jbaylon
May 29, 2014

Gallium Nitride (GaN) HEMTs for High-Power, High-Frequency Applications

Speaker: Dr. Puneet Srivastava
Massachusetts Institute of Technology (MIT)
When: Wednesday, May 28, 2014
Where: Grier room A (34-401-A) (MIT-Cambridge, MA)
Time: 12:00pm to 1:00pm

Abstract: (PDF slides) GaN-HEMTs have been identified as essential components for realizing efficient, compact, high power switching systems, and high power amplifiers at high frequencies. In the recent years, significant advancements have been made towards GaN-on-Si power devices due to lower cost and large size availability of Si. However, Si presents constraints such as limited voltage handling capabilities, which are more apparent at elevated temperatures. In my talk, I will discuss a novel Si substrate engineering approach to mitigate the high voltage and high temperature restrictions imposed by Si. Several kV devices have been achieved with high temperature capabilities in a cost effective way. The second part of my talk will focus on developing large periphery GaN-HEMTs with high power density for future kW RF amplifier systems.

Biography: Dr. Puneet Srivastava received his PhD degree from IMEC-Belgium in 2012. In his PhD (2008-2012), he worked on the fabrication and technology integration of GaN-on-Si HEMTs for power switching applications. Since September 2012, he has been working as a post-doctoral associate in EECS at MIT with Prof. Tomás Palacios in the area of high frequency GaN-electronics. He has authored/co-authored over 35 international publications and holds 2 patents. He serves as an editor for IETE-Technical Review and a member of IEEE and IEEE Electron Device Society (EDS). And he is a reviewer of various journals such as IEEE EDL, IEEE TED and APL.

III-Nitrides Technology Newsletter

By jbaylon
June 4, 2014

III-N Technology, Issue No.17 (May 2014)
This monthly newsletter presents a selection of newest scientific publications, patent applications and press releases related to III-Nitride semiconductor materials (Ga, AlN, InN and alloys).

GANEX – Newsletter No17 (May 2014)

All issues on www.ganex.fr
Free subscription on http://www.knowmade.com/ganex.html

Summary of the 2014 MIT/MTL GaN Energy Annual Review (Tuesday, June 10, 2014)

By jbaylon
June 11, 2014

MIT/MTL GaN Energy Initiative
Annual Review

IMPORTANT: Many of the presentations posted here are MIT proprietary and exclusively for the members of the MIT/MTL GaN Energy Initiative. They should be treated in a confidential manner, and they should not be distributed outside the Initiative. Thank you.

Where: 50 Vassar Street, Cambridge, MA 02139-4307
When: Tuesday, June 10, 2014
Location: Grier Room 34-401 A&B (8:00am-5:00pm)

6.10.14 Annual Review (Video Presentation)

*The PDF s*lides of each presenter are listed below. (MIT Proprietary, do not distribute)

8:45:9:30	*Prof. Tomás Palacios*: **Welcoming Remarks and update on GaN Technology at MIT (PDF)**Introduction **(PDF)** Recent Progress
9:30-10:00	*Prof. Carl V. Thompson*: **GaN-Based HEMT Reliability Testing and Modeling (PDF)**
10:00-10:30	*Prof. Silvija Gradečak*: **Closing the 'green gap': understanding In clustering in InGaN (PDF)**
10:30-10:45 Poster Session & Coffee break	
10:45-11:15	*Prof. Jesús del Alamo*: **Estimation of activation energy for degradation in GaN FETs from measurements on a single device (PDF)**
11:15-11:45	*Prof. Dimitri Antoniadis*: **Compact model development for GaN based HEMTs: Status of MVSG-HV and MVSG-RF models (PDF)**
11:45-13:00 Poster Session & Lunch	
13:00-13:30	*Mr. Kevin Bagnall* (Prof. Evelyn Wang's Group): **Advanced Thermal Characterization of GaN Power Electronics (PDF)**

13:30-14:00	*Dr. Taylor Barton*: **GaN RF Power Amplifiers for Load Modulation Architectures (PDF)**
14:00-14:30	*Prof. Dana Weinstein*: **RF MEMS Resonators in Standard GaN MMIC Technology (PDF)**
14:30-14:45 Poster Session & Coffee break	
14:45-15:15	*Prof. Hae-Seung Lee*: **GaN-CMOS Ultra High Performance Continuous-Time Delta Sigma ADC (PDF)**
15:15-15:45	*Prof. David Perreault*: **High-Frequency, High-Density Off-line AC-DC power Supply (PDF)**
15:45-16:15	*Dr. Mohammad Araghchini(Prof. Jeffrey Lang's Group)*: **Magnetics for Very-Highly-Integrated Power Electronics (PDF)**
16:15-16:45 Sponsor caucus and feedback	

Professor Yasushi Nanishi (Ritsumeikan University, Japan) July 23, 2014

By jbaylon
July 24, 2014

Plasma induced point defects in InN during RF-MBE Growth and those reduction by DERI method

Speaker: Professor Yasushi Nanishi (Ritsumeikan University) Japan
Wednesday, July 23, 2014 (MIT-Cambridge, MA)
Jackson Room(38-466)
12:00pm to 1:00pm

Abstract: (PDF slides) As decomposition temperature of InN is lower than NH_3 decomposition temperature, most of these films are prepared by RF-MBE using Nitrogen radical from plasma as group V source. In this study, we have investigated plasma induced defects in InN by RF-MBE changing plasma power during growth. It was found that even from radical source, in which most of ions are supposed to be eliminated, residual ions are supplied to the growing surface and adversely affect quality of InN with increase in carrier concentration and decrease in mobility as we increase plasma power. Positron annihilation experiments revealed that this is due to point defects generated by plasma damage. DERI method is newly developed as a growth method for high quality InN, which essentially consists of the two growth steps; metal rich growth process and the following drop let elimination process in which only nitrogen radical beam is eradiated on In metal covered surface.

Biography: Professor Yasushi Nanishihas been engaged in the research fields concerning GaAs MES FETs, Liquid Phase Epitaxy of GaAs, growth and characterization of bulk GaAs, correlation between GaAs crystal defects, and FET performances and Plasma Excited Molecular Beam Epitaxy. And he is now greatly interested in MBE growth of Nitride Semiconductors including InN, In-rich InGaN, and AlGaN, targeting their applications to electronic and optoelectronic devices. He has been a leader of two big projects,National project on high-power, high-frequency GaN electronic devices, METI and Grant in Aids for scientific research in Priority Area, MEXT.

Professor Yasushi Nanishi: (Ritsumeikan University, Japan) July 30, 2014

By jbaylon
July 30, 2014

Growth of InN and In-rich InGaN and novel nano-structures for next generation devices

Speaker: Professor Yasushi Nanishi (Ritsumeikan University) Japan
Wednesday, July 30, 2014 (MIT-Cambridge, MA)
Jackson room (38-466)
12:00pm to 1:00pm

Abstract: (PDF slides) Ten years have already passed since narrow band gap energy of InN around 0.7eV was first reported in 2002. This finding opened up new application field of group III nitride optoelectronic semiconductors to near IR wavelength region passing through optical communication wave length. Other physical parameters, like electron effective mass and peak velocity, were also revised after this new finding. Thanks to outstanding property of group III nitride semiconductorswhich can cover extremely wide range of band gap energy from 6.2eV(AlN) to 0.65eV(InN), nitride semiconductor can cover potentially full spectrum of solar energy. Recent Progress and Issues of InN material preparation and devices will be presented.

Biography: Professor Yasushi Nanishi has been engaged in the research fields concerning GaAs MES FETs, Liquid Phase Epitaxy of GaAs, growth and characterization of bulk GaAs, correlation between GaAs crystal defects, and FET performances and Plasma Excited Molecular Beam Epitaxy. And he is now greatly interested in MBE growth of Nitride Semiconductors including InN, In-rich InGaN, and AlGaN, targeting their applications to electronic and optoelectronic devices. He has been a leader of two big projects, National project on high-power, high-frequency GaN electronic devices, METI and Grant in Aids for Scientific Research in Priority Area, MEXT.

Professor Akira Uedono(University of Tsukuba, Japan) August 1, 2014

By jbaylon
August 2, 2014

Study of native and process induced defects in GaN devices by a monoenergetic positron beam

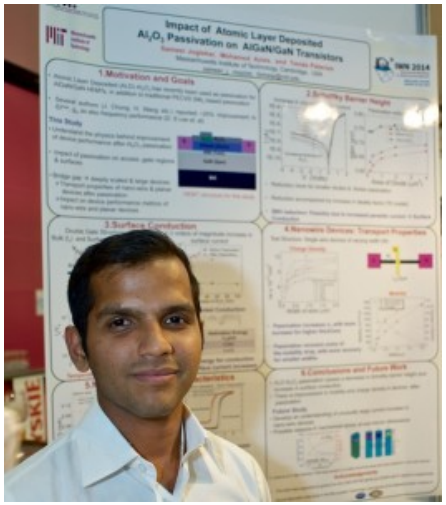
Speaker: Professor Akira Uedono (Univ. of Tsukuba, Japan)
Friday, August 1st, 2014
Grier Room A (34-401A) (MIT-Cambridge, MA)
12:00pm to 1:00pm

Abstract: (PDF slides) Positron annihilation is a non-destructive tool for investigating vacancy-type defects in group-III nitrides. A positron can also be used as a positive probe for electric fields in multilayer structures and quantum wells. With this technique, the University of Tsukuba and MIT (Palacios group) are now studying native and process induced defects in GaN devices. The defects in GaN layers grown on Si substrates by MOCVD were identified as Ga-vacancy-type deficiencies such as complexes between Ga vacancies and carbon impurities. Vacancy-type defects near interfaces between various metal contacts (Ti, Ni, and Pt) and GaN were also studied. For Ti-deposited GaN after annealing, the major defect species was identified as vacancy clusters such as three to five Ga-vacancies coupled with multiple nitrogen-vacancies. Defect behaviors in the metal films were also discussed. We have shown that the positron annihilation is a useful tool to know the properties of point defects in materials used in GaN power devices.

Biography: Dr. Akira Uedono is a Professor in the Division of Applied Physics, Faculty of Pure and Applied Science at the University of Tsukuba, Japan. His research is mainly focused on defects and atomic scale disorder in solids. His work aims at the development of positron annihilation technique for material characterization and its application for semiconductor technology and other fields.

IWN 2014 “Outstanding Poster Presentation” Wroclaw, Poland

By jbaylon
August 31, 2014



Sameer Joglekar, PhD candidate since 2011 with Prof. Tomas Palacios received the Best Poster Award at the International Workshop on Nitride Semiconductors (IWN) held in Poland the week of Aug. 24. The work which Joglekar presented, titled “Impact of AI_2O_3 Passivation on the Surface Properties and Schottky Barrier Height of AlGaN/GaN Transistors” was selected from more than 500 presentations at the IWN, the top conference in the field. Inaugurated in 2000, the International Workshop on Nitride Semiconductors is held biennially alternating with the International Conference on Nitride Semiconductors (ICNS), which covers related subject areas.

Mr. Sameer Joglekar, received his Bachelors degree in Materials Science from the Indian Institute of Technology at Mumbai in India, in August 2011. He joined Prof. Palacios’ Advanced Semiconductor Materials and Devices Group as a Ph.D candidate in November 2011. His work focuses on surface plasma treatments and effects of stress on the piezoelectric properties of AlGaN-GaN material systems.

Professor Carl V. Thompson (MIT) September 9, 2014

By jbaylon
September 9, 2014

The Role of Physical Defects in Electrical Degradation of GaN HEMTs

Speaker: Professor Carl V. Thompson
Tuesday, September 9th, 2014
Grier Room A (34-401A) (MIT-Cambridge, MA)
12:00pm to 1:00pm

Abstract: (PDF pending) Past studies have shown correlations between electrical and physical degradation during reliability testing of GaN HEMTs. This physical degradation is often in the form of pits that form in high-field regions near gate edges. Degradation is accelerated by the presence of water and it has been argued that pits form as the result of a reduction-oxidation reaction of water with GaN and AlGaN to form gallium oxide. Recent work suggests that threading dislocations also play an important role in determining the locations of pits. A catalytic role of dislocations in pit formation would suggest an important role in determining the overall degradation rate. Experimental results that lead to these conclusions will be reviewed.

Biography: Professor Carl V. Thompson is the Stavros Salapatas Professor of Materials Science and Engineering in the Department of Materials Science and Engineering at MIT. He also directs MIT's Materials Processing Center. His research covers a range of topics concerned with structure evolution and control during processing of thin films and nanostructures, as well as assessment of the reliability of thin films and nanostructures in electronic devices and systems.

Ms. Laura C. Popa & Mr. Bichoy Bahr(MIT): Friday, September 19, 2014

By jbaylon
September 19, 2014

Monolithic MEMS Resonators and Oscillators in GaN MMIC Technology

Speakers: Ms. Laura C. Popa & Mr. Bichoy Bahr
(Prof. Dana Weinstein's Group) – MIT
Department of Physics &Department of Electrical Engineering and Computer Science
Friday, September 19, 2014
Grier Room A (34-401A)
12:00pm to 1:00pm


*This seminar is supported by the MIT-MTL GaN Energy Initiative
Abstract: As a wide band-gap semiconductor with large breakdown fields and saturation velocities, gallium nitride (GaN) has been increasingly used in high-power, high-frequency electronics and monolithic microwave integrated circuits (MMICs). Together with a strong piezoelectric coupling (kT2~2%), these properties make GaN ideal for RF MEMS resonators, and offers a platform for seamless integration of high performance RF MEMS resonators with high power, high frequency electronics. Monolithic integration of MEMS resonators with ICs leads to reduced parasitics and matching constraints, enabling low phase-noise clocks and frequency-selective filters for signal processing and high-frequency wireless communications.

In this talk, we will present the design, optimization and fabrication of multi-frequency piezoelectric MEMS resonators that achieve the highest frequency-quality factor product in GaN to date. We will also highlight the unique transduction capabilities of GaN, such as the ability to use the 2D electron gas (2DEG) as a switchable electrode for transduction. These high performance resonators are used as building blocks to demonstrate the first monolithic GaN MEMS-based oscillators, where active HEMTs along with passives and resonators are all integrated on the same chip. We will discuss our recent results of monolithic Pierce and Colpitts oscillators using 1 GHz GaN MEMS resonators. This first demonstration of low-phase noise, small foot-print monolithic GaN-MEMS oscillators paves the road towards compact and power efficient RF front-ends for wireless communication systems.

Biography: Ms. Laura Popa completed her undergraduate work at Bryn Mawr College in 2009 and is currently a PhD candidate in the Physics department at MIT. As a graduate student, she became interested in device physics and MEMS, and joined the HybridMEMS group in 2010. Her research focuses on multi-GHz piezoelectric Gallium Nitride RF MEMS resonators for filter and timing applications in wireless communications.

Mr. Bichoy Bahr received his M.Sc. degree from Ain Shams University, Cairo, Egypt in 2012. He is currently a Ph.D. student in EECS Department at MIT. Mr. Bahr joined the HybridMEMS group in 2012. His research interests include the modeling, design and fabrication of monolithically integrated hybrid MEMS multi-GHz oscillators, both in CMOS and GaN. He is also interested in unreleased CMOS resonant body transistors.

Slides and Video will become available soon. (Please contact Laura Cornelia Popa (lpopa@mit.edu) or Bichoy Bahr (bichoy@mit.edu) for a copy of the slides or video)

2104 Nobel Prize in Physics: Press Release (10/7/14)

By jbaylon
October 7, 2014

The Royal Swedish Academy of Sciences has decided to award the Nobel Prize in Physics for 2014 to

Isamu Akasaki
Meijo University, Nagoya, Japan and Nagoya University, Japan

Hiroshi Amano
Nagoya University, Japan

and

Shuji Nakamura
University of California, Santa Barbara, CA, USA

"for the invention of efficient blue light-emitting diodes which has enabled bright and energy-saving white light sources"

Read More

Professor Sylvia Gradecak (MIT) October 17, 2014

By jbaylon
October 18, 2014

Closing the green gap: Understanding In clustering in InGaN LEDs

Speaker: Professor Silvia Gradečak –MIT
Friday, October 17, 2014
Grier Room A (34-401A) (MIT-Cambridge, MA)
12:00pm to 1:00pm

*This seminar is supported by the MIT-MTL GaN Energy Initiative
Abstract: Since the discovery of blue light emitting diodes (LEDs), GaN/InGaN LED heterostructures have sparked tremendous interest. In spite of high density of dislocations, InGaN-based LEDs emit intense light, whereas presence of even a fraction of this dislocation density in other semiconductor LEDs completely quenches the light emission. It has been proposed that InGaN can undergo spinodal decomposition resulting in the formation of In-rich clusters, which act as sinks for electron-hole pairs. We have employed CS-corrected scanning transmission electron microscopy imaging and electron-energy loss spectroscopy measurements below the knock-on threshold and without introducing electron beam artifacts to determine the compositional variation in InGaN quantum wells. We show that no gross-scale compositional fluctuations are present in those samples, and, importantly, they are apparently not critical for strong light emission. Finally, we have also established a systematic methodology to directly correlate optical and structural properties of InGaN-based nanostructures with nanoscale resolution.

Biography: Prof. Silvija Gradečak is an Associate Professor of Materials Science and Engineering in the Department of Materials Science and Engineering at MIT. She obtained her PhD in Physics from the Swiss Federal Institute of Technology in Lausanne, Switzerland. Her interdisciplinary research program is based on synthesis of nanostructured materials and their assembly into functional devices for applications in nanophotonics, nanoelectronics, and in energy harvesting and conversion. Silvija is a recipient of the NSF CAREER Award, inaugural Nano Letters Young Investigator Lectureship, and 3M Innovation Award.

Mr. Seungbum Lim- MIT (Prof. David Perreault' s Group) October 23, 2014

By jbaylon
October 24, 2014

Miniaturized High-Frequency Power Conversion for Grid Interface

Speaker: Mr. Seungbum Lim- MIT
(Prof. David Perreault' s Group)
Laboratory of Electromagnetic and Electronic Systems (LEES)
Thursday, October 23,2014
Grier Room A (34-401A)
12:00pm to 1:00pm

*This seminar is supported by the MIT-MTL GaN Energy Initiative

Abstract: PDF slides A new ac-dc power conversion architecture is proposed for realizing miniaturized ac-dc converters operating at high frequencies (HF, 3-30 MHz) and high power factor, without the need for electrolytic capacitors. This approach, which takes advantage of GaN devices, is valuable for miniaturization of all kinds of grid-interface power supplies, such as LED drivers and computer power supplies. The proposed architecture is especially suited for systems operating at HF (above 3 MHz), and we introduce circuit implementations that enable efficient operation at these frequencies and which leverage wide band-gap devices effectively. The proposed approach is demonstrated for an LED driver operating from 120 Vac, and supplying a 35 V, 30 W output. The prototype converter operates at a (variable) switching frequency of 5–10MHz – approximately 100x that of conventional designs, and achieves a power density of 50 W/in3 – approximately 10x that of commercial designs. Despite its high frequency and power density, the system achieves an efficiency of 92 % while providing 0.88 power factor without the use of electrolytic capacitors, thereby providing improved power quality, reliability and lifetime compared to conventional designs.

Biography: Seungbum Lim received the B.S. degree in electrical engineering from Seoul National University in 2010 and the S.M. degree in electrical engineering from the Massachusetts Institute of Technology in 2012, where he is currently working toward the Ph.D. degree in the

Laboratory of Electromagnetic and Electronic Systems. His research interests include power electronics, resonant converters, soft-switching techniques, and RF power amplifiers.

Dr. SungWon Chung (MIT-MTL): Friday, October 31, 2014

By jbaylon
October 29, 2014

1 GS/s GaN Tack-and-Hold Amplifier

Speaker: Dr. SungWon Chung (MIT-MTL) (*Prof. Hae-Seung Lee's Group)*

Microsystems Technology Laboratories (MTL)

Friday, October 31, 2014
12:00pm to 1:00pm

This seminar is supported by the MIT-MTL GaN Energy Initiative

Abstract: (PDF) As the CMOS technology scales down, the performance of mixed-signal circuits such as track-and-hold circuits, analog-to-digital converters (ADCs), and digital-to-analog converters (DACs) has continuously advanced. However, the low supply voltage of deeply scaled CMOS transistors limits the dynamic range of analog signal and consequently becomes a fundamental barrier to the performance of these circuits in Si technology due to the thermal noise. GaN HEMTs, which operate at very high supply voltages of 20V and higher, significantly alleviate the SNR limit imposed by a low power supply voltage. In addition, the GaN HEMTs provide bandwidth comparable to CMOS transistors. Eventually, a hybrid technology, which monolithically integrates GaN HEMTs with CMOS transistors on a single wafer, can take the advantage of the both technologies, enabling potentially revolutionary mixed signal performance. For example, the GaN first stage of a pipeline ADC may produce the residue without the need for amplification, which can greatly simplify the design and improve speed without SNR degradation. The residue from the GaN first stage can then be handled by a CMOS backend with a low supply voltage for further processing and calibration.

Previous works in GaN circuits have focused on power conversion, RF power amplifiers, and low noise amplifiers. This talk presents the first GaN track-and-hold circuit to culminate the performance and demonstrate the feasibility of, for example, a 1 GS/s hybrid GaN-CMOS pipeline ADC. The Schottky diode turn-on, which is a key design challenge for GaN track-and-hold circuit, is prevented by a gate-bootstrapping circuit with a switchable

source-degenerated current source. The gate-bootstrapping GaN track-and-hold circuit demonstrates 70dB SNR at 800 MS/s for low-frequency input signal, showing a potential to realize a hybrid GaN-CMOS ADC with 4-5 bit higher resolution than the state-of-the-art CMOS/BiCMOS ADCs at the same sampling rate.

Biography: Dr. SungWon Chung is a postdoctoral fellow at the University of Southern California, and is also a research affiliate at MTL. He received his degrees all in electrical engineering, the B.S. degree from Pusan National University, the M.S. degree from KAIST, and the Ph.D. degree from MIT. He was a postdoctoral associate at MTL working on mixed-signal GaN circuit design in 2014. His research interests include circuit and system design for mobile communication.

Resource Spotlight: MIT/ ILP Institute Insider (Prof. Tomas Palacios)

By jbaylon
November 3, 2014

Extreme Materials and Ubiquitous Electronics

Tomás Palacios explores the application of novel materials in next-generation electronics to save energy and expand possibilities.

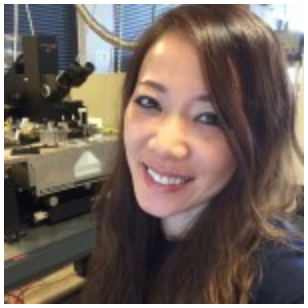
Nearly everyone seems to carry a cell phone or tablet. But if Tomás Palacios's vision of the future of electronics comes to bear, it will be increasingly difficult to separate electronics from all the other structures and materials surrounding us. An electrical engineer by training, Palacios, MIT Associate Professor of Electrical Engineering and Computer Science, develops new materials to bring electronic devices to the next level and beyond. "We are always trying to mix materials, engineering and physics to create a prototype device that can get people excited about new applications and opportunities," he says. Read More

Direct Link to Video

Ms. Alex Guo – MIT (MTL) November 5, 2014

By jbaylon
November 5, 2014

Positive-Bias Temperature Instability of GaN MOSFETs



Wednesday, November 5, 2014
RLE Allen Rm 36-462
Time: 1:00-2:00PM

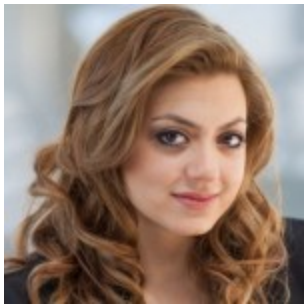
Abstract: (PDF slides) Recently, GaN-HEMTs with insulated-gate (MIS-HEMTs) have attracted much attention because they offer high breakdown voltage and low gate leakage current. However, this new device structure comes with new reliability and stability concerns. One of them is the threshold voltage instability after high voltage stress. To address this, we use a simple GaN MOSFET structure and study the positive bias temperature instability (PBTI) of the oxide/GaN system. We examine two gate dielectrics: SiO2 and a SiO2/Al2O3 composite. Our findings suggest that the combination of electron trapping in pre-existing oxide traps and the generation of interface states under gate stress are the two main mechanisms responsible for the PBTI phenomenon in GaN MOSFETs. These findings are consistent with similar studies for Si, SiC and III-V MOSFETs.

Biography: Alex Guo received her B.S. degree with honors from UC Berkeley in 2010 and S.M. degree from MIT in 2012, both in Electrical Engineering and Computer Science. Alex is a NDSEG research fellow and she is working towards her PhD degree in the Microsystems Technology Laboratories at MIT. Currently, Alex is investigating the physics and reliability issues of GaN power electronics.

Dr. Banafsheh Barabadi (DRL/MIT) Friday, November 7, 2014

By jbaylon
November 7, 2014

Thermal Characterization of GaN HEMTs via Micro-Raman Spectroscopy and Photo-Thermal Reflectance Thermography



Speaker: Dr. Banafsheh Barabadi – MIT
(Prof. Evelyn N. Wang's Group)
Device Research Laboratory
Department of Mechanical Engineering
Friday, November 7, 2014
Grier A, 34-401A
12:00pm – 1:00pm(EST)

Abstract: Gallium nitride (GaN)-based high electron mobility transistors (HEMTs) have gained a significant amount of interest over the last years for their excellent electrical properties, high efficiencies, and high power densities for both power electronics and radio-frequency applications. However, these high power densities result in high channel temperature and temperature gradients which induce thermo-elastic stresses, formation of defect sites, and many other degradation mechanisms that substantially affect the performance and reliability of GaN HEMTs. Therefore, it is important to develop reliable tools for thermal and mechanical characterization of GaN HEMTs.

To have a comprehensive understanding of thermal management in GaN devices, we have utilized micro-Raman spectroscopy and photo-thermal reflectance thermography techniques. Micro-Raman spectroscopy is known as one of the most powerful techniques capable of measuring the local device strain, stress, and temperature with a spatial resolution of 1 μm. Using micro-Raman spectroscopy, we have measured the temperature profiles on ungated AlGaN/GaN structures on SiC substrates. Thermal-reflectance thermography is another well-established metrology that is fully optical and noncontact. By choosing the appropriate illumination wavelength we have achieved a spatial resolution of 0.3 μm for GaN devices on various substrates. We have also improved the photo-thermal reflectance setup by developing a new calibration method and optimizing the temperature measurement procedure to obtain a reliable and accurate map of the temperature profiles. By utilizing these characterization tools, we can better

understand the structural and thermal changes in GaN HEMTs, the formation of defect sites, and their relation to temperature through high resolution thermal imaging.

Biography: Dr. Banafsheh Barabadi joined the Device Research Laboratory (DRL) at MIT in January 2014 as a postdoctoral associate after receiving her Ph.D. in Mechanical Engineering from Georgia Institute of Technology. Her doctoral research involved numerical and experimental study of Joule heating in nano-scale embedded on-chip Interconnects. Dr. Barabadi's current research involves thermal characterization and management of Gallium Nitride (GaN)-based high electron mobility transistors (HEMTs) and developing cooling mechanisms for ultra-high heat fluxes

Dr. Taylor Barton (UT-Dallas/MIT) November 14, 2014

By jbaylon
November 14, 2014

All-Transmission-Line Multi-Way Outphasing and Power Combining for Efficient Microwave Power Amplification

Friday, November 14, 2014
12PM-1PM EST via WebEx

Abstract: (PDF slides) Increasing demand for high data rates in communications has led to complex modulation schemes intended to maximize spectral efficiency in a restricted frequency band. The modulated signals in these systems tend to have high peak-to-average power ratios (PAPRs), requiring the RF power amplifier (PA) to operate over a wide range of power levels. This talk will focus on a PA architecture based on an all-transmission-line power combining network that provides improved modulated efficiency in such applications.

RF PAs tend to achieve their highest drain efficiencies under highly saturated (i.e. constant-envelope) operation. In the ideal limit, the transistor acts as a switch rather than a current source, minimizing intrinsic transistor loss. Although achieving true switched mode operation has historically been difficult due to device limitations, GaN HEMTs have enabled drain efficiencies reaching 80% and higher at frequencies beyond 1 GHz. As device performance evolves, achievable efficiency under saturated operation will continue to move closer to the limit of fully switched-mode performance.

The outphasing system presented in this seminar takes advantage of the capabilities of GaN devices in an architecture that modulates the effective load impedance of multiple switched-mode PAs to provide linear output power control. In contrast to related versions of this technique presented previously, the combining network is implemented using only series-connected transmission lines. The four-way transmission-line power combining network overcomes operating efficiency limitations of conventional 2-way outphasing systems, while having greater potential to scale in size and frequency compared to previous implementations.

Biography: Dr. Taylor Barton is an Assistant Professor of Electrical Engineering at the University of Texas at Dallas. Prior to joining UT Dallas this year, she was a post-doctoral associate at MIT in the Microsystems Technology Laboratories. Dr. Barton received the Sc.D. degree from MIT in 2012 for her research in energy-efficient power amplifiers for wireless communications, and also holds Sc.B., M.Eng., and E.E. degrees from MIT's EECS department Her research interests include design of RF and microwave circuits for high efficiency.

Mr. Ujwal Radhakrishna (MIT) December 19, 2014

By jbaylon
February 4, 2015

HV-GaN HEMT: Device modeling, design for optimization and circuit-level benchmarking

Speaker: Mr. Ujwal Radhakrishna
(Prof. Dimitri Antoniadis Group) (MIT)
Department of Electrical Engineering and Computer Science

Abstract: (PDF slides) The MIT Virtual Source Model (MVSG-HV) developed to model HV-GaN HEMTs has physics-based core-current and charge equations that can capture device terminal-behavior accurately. The model is also able to estimate peak electric field distribution in a given device structure, at any applied V_{DS} value. HV-GaN HEMTs often have source- and/or gate-connected field plates that enhance breakdown voltage and affect the $BV^2/R_{on}Q_g$ figure-of-merit (FoM) along with impacting the dynamic switching behavior of the device, which the model is able to capture.

This talk will focus on the validation of the compact model by comparison against DC-IV and static-CV measurements of industry devices at different temperatures. The model includes transport and charges in field-plated regions of the device, which enables calculation of the $BV^2/R_{on}Q_g$ FoM as a function of field plate design parameters (lengths and dielectric thicknesses) which will be illustrated for a device with a source and gate-connected field plate. Interactions among field-plated regions of the device while switching results in dynamic non-quasi-static charge distribution that is different from the static charge distribution obtained from CV measurements. This impacts the switching behavior of the device in HV-circuits such as convertors, affecting their performance and reliability. The MVSG-HV model is able to capture this dynamic device behavior which will be shown using benchmarking against board-level slew rate measurements of a commercial buck-convertor.

Abstract: Mr. Ujwal Radhakrishna is a Ph.D. candidate in the Department of Electrical Engineering and Computer Science at MIT and is working in the Microsystems Technology Laboratory under the supervision of Professor Dimitri Antoniadis. Before attending MIT, Ujwal earned B.Tech and

M.Tech degrees in Electrical Engineering with specialization in Microelectronics and VLSI from the Indian Institute of Technology Madras, India in 2010-11. His current research interests include solid-state physics, device modeling and device-circuit characterization. As part of the MIT/MTL GaN Energy Initiative, he is working to develop compact models for GaN based HEMT devices to enable circuit design for RF and HV operation of GaN based electronics. Ujwal has interned at Fairchild Semiconductor, Analog Devices and Texas instruments. He is the recipient of Institute merit award and DAAD scholarship.

2016 MIT/MTL GaN Energy Initiative Annual Review

By jbaylon
May 23, 2016

Members of the MIT/MTL GaN Energy Initiative, you are cordially invited to attend the 2016 Annual Review Meeting held at the Massachusetts Institute of Technology (MIT) Cambridge, MA on Thursday, June 9th, 2016.

Date: Thursday, June 9, 2016

Time: 8:30am to 1:30pm

Venue: Massachusetts Institute of Technology (MIT) Grier Room (34-401B)

Registration

Registration closed.

Agenda

MTL GaN Review Agenda

Presentations

All presentations of the annual review will be available for all members of the MIT/MTL GaN Energy Initiative directly after the meeting, but this is only exclusive to Analog Devices and MIT. (Click here if you are with Analog or MIT member of the center.)

Questions?

For any questions regarding the annual review, please contact Joseph Baylon (jbaylon@mit.edu).

2016 MIT/MTL GaN Energy Initiative

By jbaylon
December 19, 2016

Members of the MIT/MTL GaN Energy Initiative, you are cordially invited to attend the final half of the 2016 Annual Review Meeting held at the Massachusetts Institute of Technology (MIT) Cambridge, MA on Wednesday, December 21, 2016.

Date: Wednesday, December 21, 2016

Time: 8:45am to 1:30pm

Venue: Massachusetts Institute of Technology (MIT) Grier Room (34-401B)

Please register by clicking the "registration" link below. Thank you.

Registration

Agenda – December 21, 2016

Presentations

All presentations of the annual review will be available for all members of the MIT/MTL GaN Energy Initiative directly after the meeting, but this is only exclusive to Analog Devices and MIT.

Questions?

For any questions regarding the annual review, please contact Joseph Baylon (jbaylon@mit.edu).

MIT/MTL GaN Energy Initiative (Dec. 21st, 2016)

By jbaylon
January 20, 2017

Members of the MIT/MTL GaN Energy Initiative, you are cordially invited to attend the final half of the 2016 Annual Review Meeting held at the Massachusetts Institute of Technology (MIT) Cambridge, MA on Wednesday, December 21, 2016.

Date: Wednesday, December 21, 2016

Time: 8:45am to 1:30pm

Venue: Massachusetts Institute of Technology (MIT) Grier Room (34-401B)

Click title of their talk to view the PDF slides

9:20-9:30 Prof. Tomás Palacios: Welcoming Remarks (recorded on the video listed below)

9:30-10:00 Prof. Jeehwan Kim: **Recent progress on dislocation-free GaN on graphene and future directions**

https://youtube.com/watch?v=

10:00-10:30 Dr. Gabriele Grosso (Prof. Dirk England's Group): **Atomic Color Centers in Wide-Bandgap Semiconductors**

https://youtube.com/watch?v=

10:30-10:45 Break

10:45-11:15 Prof. Ruonan Han: **Highly-Scalable 2D Radiator Structures for 1-THz Signal Generation and Beam-Steering Imager**

https://youtube.com/watch?v=

11:15-11:45 Dr. Ujwal Radhakrishna (Prof. Dimitri Antoniadis's Group): **Linear Performance of GaN HEMT Technology: Modeling, Analysis and Improvement Techniques**

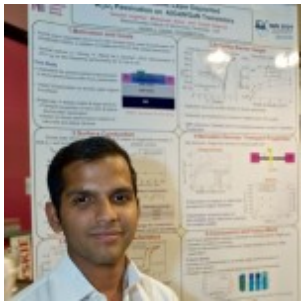
https://youtube.com/watch?v=

11:45-12:15 Mr. Kevin Bagnall (Prof. Evelyn Wang's Group): **Electro-thermo-mechanical characterization of GaN HEMTs via micro-Raman spectroscopy**

https://youtube.com/watch?v=

CS Mantech: Mr. Sameer Joglekar 2016 Best Student Paper Award

By jbaylon
April 12, 2017



Congratulations to Mr. Sameer Joglekar for his 2016 Best Student Paper Award "**Simulation of Fabrication- and Operation -Induced Mechanical Stress in AlGaN/GaN Transistors**" He along with his fellow authors presented at the 2016 International Conference on Compound Semiconductor Manufacturing in Miami, Florida.

The Best Student Paper Award is the presentation and the material, which is to be outstanding by the various attendees from industry, academia and the government labs. This award recognizes and supports student accomplishments as well as promoting the conferences mission while establishing relationships that increase the knowledge of our Industry.

Please join us in congratulating Sameer for his outstanding work.

MIT-MTL GaN Energy Initiative Review @ MIT (May 3, 2018)

By jbaylon
February 11, 2018

MIT-MTL GaN Energy Initiative Annual Review

Thursday, May 3, 2018

Center for Ultracold Atom (CUA) Seminar Room (26-214)

1:00pm-4:30pm

MEETING AGENDA

1:00pm-1:15pm Registration and refreshments

1:15pm-1:55pm Professor Jeehwan Kim (40 min.)

2D material-based layer transfer (2DLT) of GaN HEMTs

https://youtube.com/watch?v=

1:55pm- 2:35pm Professor Tomás Palacios (40 min.)

Vertical GaN Fin Transistors for 200 V Applications

https://youtube.com/watch?v=

2:35pm-2:50pm BREAK (15 minutes)

2:50pm-3:30pm Professor Evelyn Wang (40 min.)

Nanoscale characterization of GaN HEMTs with nano-Raman Spectroscopy

https://youtube.com/watch?v=

3:30pm-4:10pm Professor Carl Thompson (40 min.)

GaN-Based HEMT Reliability Testing and Modeling

https://youtube.com/watch?v=