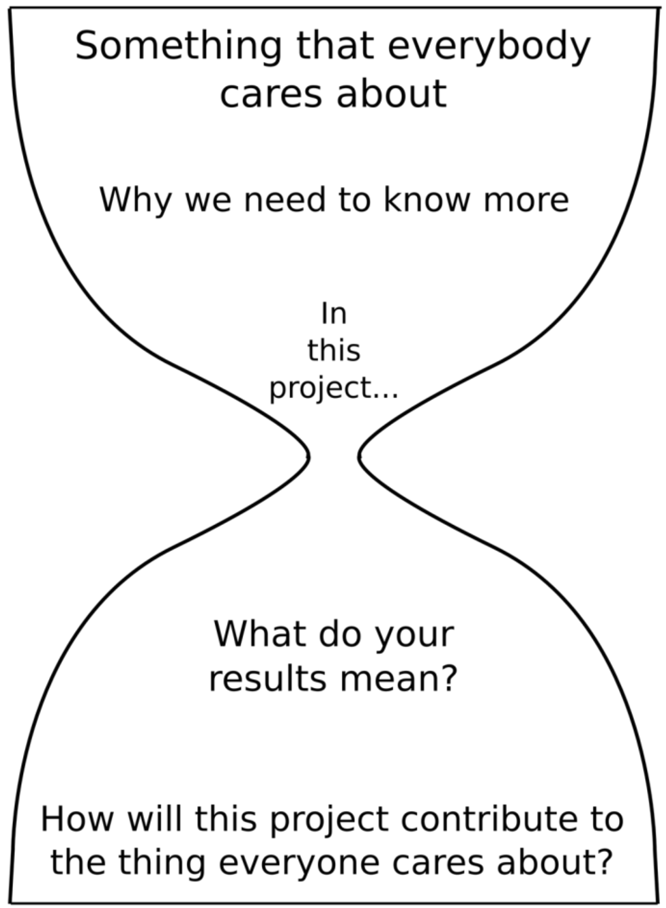
An effective abstract is an hourglass-shaped message.



Scott Olesen, BE Communication Fellow

What is something everyone cares about?

- General background examples:
  - Thermophotovoltaic (TPV) systems are promising as small scale, portable generators to power sensors, small robotic platforms, and portable computational and communication equipment.
  - Sub-wavelength antennae are a fundamental building block for a plethora of imaging, sensing, and photodetection devices.
  - Convolutional Neural Networks (CNN) have emerged to provide the best results in a wide variety of machine-learning (ML) applications, ranging from image classification to speech recognition.
  - Artificial Intelligence (AI) is revolutionizing how we learn, connect, and experience the world.

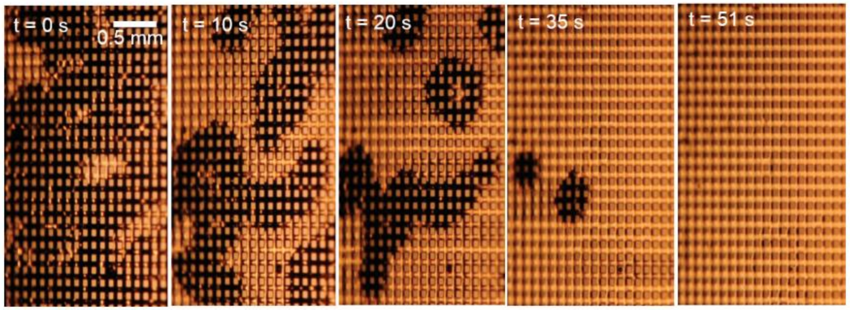
What is something everyone cares about?

- Implications examples:
  - This research opens up opportunities for further developments of ultrathin optical devices with tunable phase and amplitude switching.
  - This could enable low power ubiquitous ML applications for a smart Internet-of-Everything.
  - Optimization of the magnetic properties in Mn2 Rux Ga films promises fast, stable, and energy-efficient spintronic devices.

An effective abstract is an hourglass-shaped message.

Gas Spreading on Superhydrophobic Surfaces Immersed Underwater

Superhydrophobic surfaces submerged under water appear shiny due to a thin layer of air (‘plastron’) trapped in their surface texture. This entrapped air is advantageous for both anti-corrosion as well as frictional drag reduction in various applications ranging from microfluidic channels to marine vessels. However, these aerophilic textures are prone to impregnation by water due to turbulent pressure fluctuations and dissolution of the trapped gas into the water. We demonstrate a novel chemical method to replenish the plastron by using the decomposition reaction of hydrogen peroxide on a superhydrophobic silicon micro-post texture that incorporates a platinum catalyst. We also provide a thermodynamic framework for designing superhydrophobic surfaces with optimal texture and chemistry for underwater plastron regeneration. We finally demonstrate the practicability of this method by fabricating scalable surface textures on aluminum that incorporates a cheap catalyst, manganese dioxide, thus enabling plastron regeneration on larger length scales for ocean-going applications.



◄ Figure 1: In-situ gas generation and spreading on a superhydrophobic texture immersed in water. The texture is comprised of silicon micro-posts, platinum catalyst and TeflonTM.

General background
Specific background
Statement of problem or knowledge gap
“Here we show…” one-sentence summary of what was done/learned
Detailed summary of high-level results
Implications

An effective abstract is an hourglass-shaped message.

Gate Dielectric Reliability under AC Stress in High-Voltage GaN Field-Effect Transistors

Energy efficient electronics have been gaining attention as a solution to meet the growing demand for energy and sustainability. GaN field-effect transistors (FET) show great promise as high-voltage power transistors due to their ability to withstand a large voltage and carry large current. At the present time, the GaN metal-insulator-semiconductor high-electron-mobility-transistor (MIS-HEMT), the device of choice for electric power management, is limited from commercialization due to many challenges, including gate dielectric reliability. Under continued gate bias, the dielectric ultimately experiences a catastrophic breakdown that renders the transistor useless, a phenomenon called time-dependent dielectric breakdown (TDDB).

Our research aims to understand the physics of TDDB in GaN MIS-HEMTs. So far, efforts are focused on constant voltage stress due to the ease of experimental and instrumental setup. In contrast, our research aims to study the effects of applying AC stress to the gate. This mimics the real-world operating environment of FETs in power conversion circuits where they experience rapid transitions between the ON state and the OFF state.

In this work, we report the observation of an improvement in dielectric reliability under AC stress, as compared with DC stress, under identical gate bias and stress time. This improvement appears to be largely independent of frequency. These results, if confirmed, suggest a much better dielectric reliability of GaN MIS-HEMTs than previously believed.

General background
Specific background
Statement of problem or knowledge gap
“Here we show…” one-sentence summary of what was done/learned
Detailed summary of high-level results
Implications

Tips for writing a good abstract

1. Keep in mind that most of the audience, while technically savvy, is very unfamiliar with your field.
2. Focus on clearly explaining what the problem is and the impact of your solution; outline your solution method at a high level, but avoid details.
3. Make clear what stage the project is at, and therefore what kind of evidence will be available (e.g. calculations vs simulations vs experiments).
4. Be factual, descriptive, and objective; avoid conjecture.
5. Avoid jargon, acronyms; if you absolutely must use a specialized term, define or explain it.
6. Note your sponsorship below the title/authors (see examples and template).
7. Use correct spelling, grammar, punctuation.
8. Be as concise as possible.

Avoid common problems to improve your article

Avoid passive voice

ORIGINAL: The modified instrument designs were developed by the Glucose Monitor Group.

EDITED: The Glucose Monitor Group (GMG) developed the modified instrument designs.

Eliminate deadwood and roundabout words and expressions.

ORIGINAL: It is the purpose of this section of the report to discuss the increased heat output of numeric co-processors.

EDITED: This section discusses the increasing heat output of numeric co-processors.

Avoid Doublings

ORIGINAL: We will discuss and explain any special factors and considerations in a separate report.

EDITED: We will discuss any special considerations in a separate report.

Simplify Complex Sentence Patterns

ORIGINAL: We have developed a testing method which consists of a set of uncomplicated, dependable, and economical bioassays that cover most significant toxic reactions that might be expected by which we can identify the toxicity of a sample without knowing its chemical contents.

EDITED: We developed a testing method to identify the toxicity of a sample, even if the chemical contents are unknown. The test's bioassays are uncomplicated, dependable, and economical.

Keep Parallel Thought Parallel

ORIGINAL: The T Cell statisticians were given training in organizing technical data and in how to present their conclusions.

EDITED: The T Cell statisticians learned how to organize data and present conclusions.

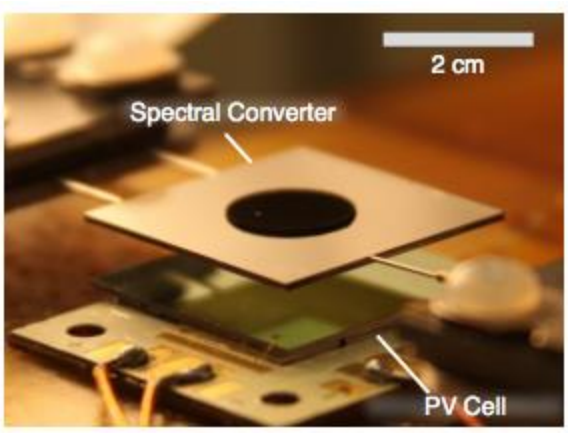
Avoid roundabout expressions

Wordy	**Improved**
at the present time	now
by means of	with, by
due to the fact that	because, since
for the purpose of	for
in a number of cases	some
in relation to	toward, to
in the event of	if
in view of	because, since

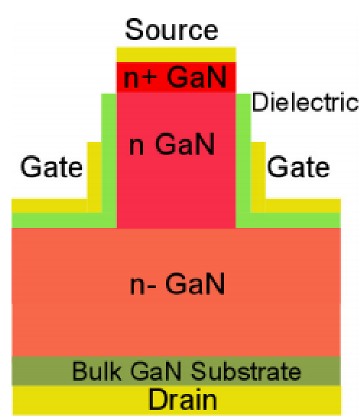
General Comments on Abstract Figures

The image should convey a high-level idea of **your** research topic (refer to the examples below). NO GRAPHS allowed – they will be removed from your abstract for publishing. The image will appear in a horizontal space beneath your abstract text, so landscape-oriented images work best. Submit your image as a separate attachment, with a name lastname_keyword.jpg or lastname_keyword.tif (only .jpg/.jpeg or .tif/.tiff formats accepted).

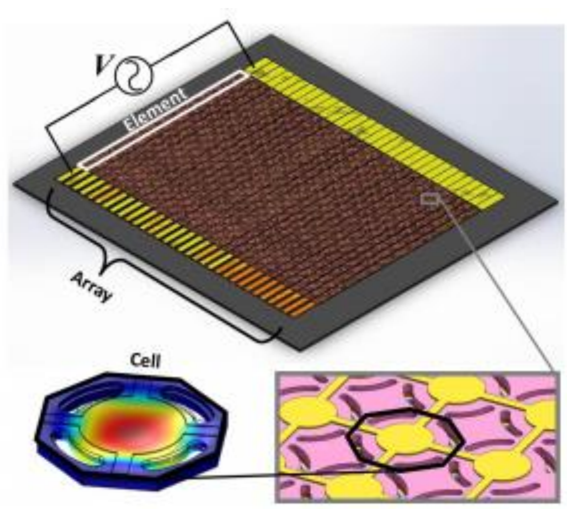
These images are great for the abstracts! They give a clear idea of what the research was about.



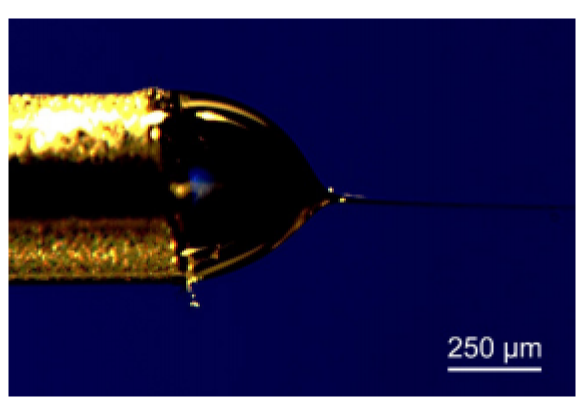
Using a spectral converter to improve photovoltaic conversion. Font size can be bigger



Vertical GaN power transistors on Bulk GaN substrate

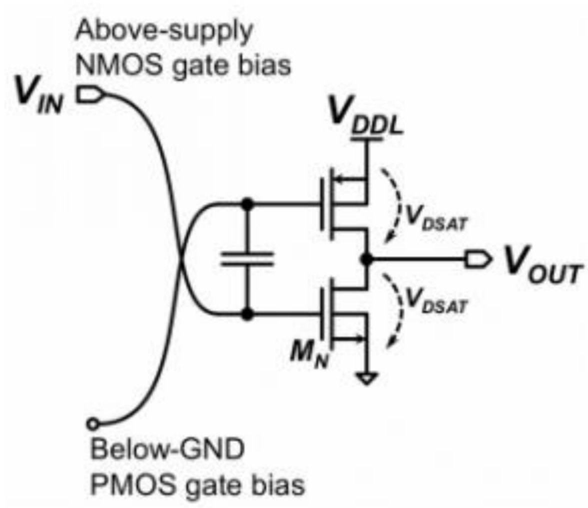


Piezoelectric transducer array for medical

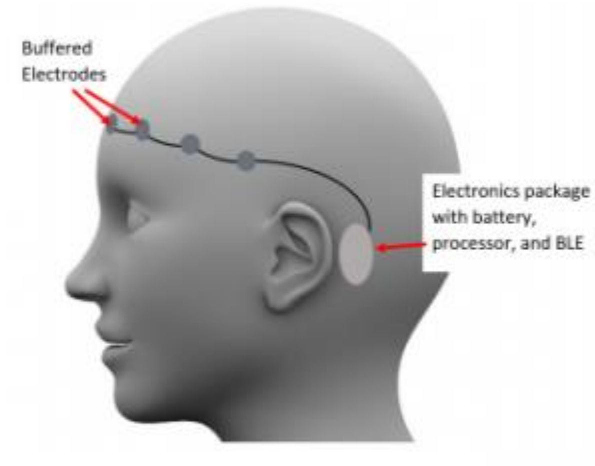


Electrospun piezoelectric microfibers for imaging. Font size can be bigger.

wearable energy harvesting

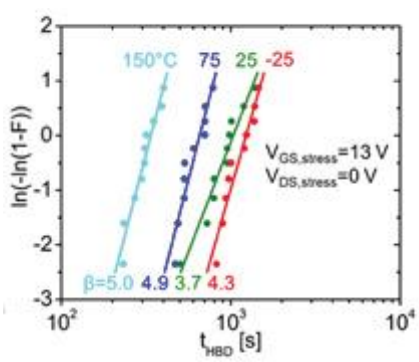


Novel inverter circuit to operate from very low voltages

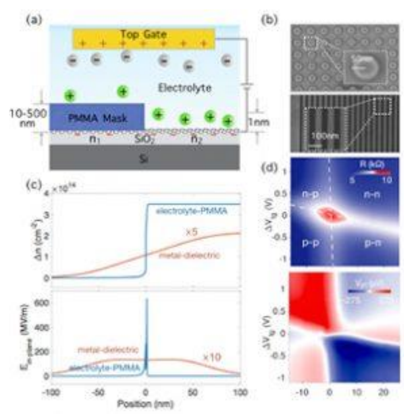


Wearable EEG system. Needs a bigger font size

These images should be avoided for the abstracts!



No graphs, please. Even when they're well-made like this.



The image is too busy for the small space available.

The image is too small and the details are too faint to be read.

CNN	LeNet	AlexNet	VGG16
Year	1989	2012	2014
# of Convolution Layers	2	5	13
# of weights	50k	2.3M	14.7M
Ratio (memory)	**1x**	**46x**	**294x**
# MACs	322k	666M	15.3G
Ratio (Computation)	**1x**	**2067x**	**47660x**

AlexNet

Layer	Filter Size (R)	# Filters (M)	# of Channels (C)	Stride
1	11x11	96	3	4
2	5x5	256	48	1
3	3x3	384	256	1
4	3x3	384	192	1
5	3x3	256	192	1

No tables, either.

Example of finished and formatted MARC abstract page with image and without.

Sihan Xie
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Seeking summer internship.
SM advised by Vladimir Bulović.
Available from June 2020.

Research Interests:
Displays, light-emitting diodes, optoelectronics, organic materials.

High-Performance Inorganic CsPbBr3 Perovskite Light-Emitting Diodes by Dual Source Vapor Deposition

6.09

S. Xie, A. Osherov, V. Bulović

Sponsorship: U.S. Department of Energy EFRC

Organometal halide-based perovskites, with the typical chemical formula ABX3, have emerged as a promising class of semiconducting materials for thin-film optoelectronics in the past few years. Those semiconductors possess unique electro-optical properties, such as longrange carrier diffusion length, high absorption coefficients, and low levels of defect states, yielding solar cells with over 20% power conversion efficiency. While many of the research efforts have been captivated by the potential of their photovoltaic applications, perovskites are nonetheless promising light emitters. Indeed, color-tunable electrically-driven perovskite light-emitting diodes (PeLEDs) have tremendous potential for novel display and lighting applications. In addition to its bright photoluminescence (PL) and excellent wavelength tunability, CsPbX3 (X=I, Br, Cl) in particular exhibits superior thermal and chemical stabilities when compared to organic-inorganic analogs such as CH3NH3PbX3.

Unfortunately, low solubility limits of CsBr precursor hinder the fabrication of a dense, compact CsPbBr3 layer with complete coverage and smooth morphology via solution processing. Incomplete coverage of perovskite emitting layers results in substantial leakage current that has limited the luminescent efficiency of previously reported cesium-based PeLEDs. Physical vapor deposition of fully inorganic CsPbX3 perovskites offers a scalable alternative to solution processing. In this work, we report a systematic approach for preparation of highly efficient CsPbBr3 PeLEDs using vacuum deposition. Fabrication of CsPbBr3 thin films with complete surface coverage and reduced roughness in addition to precise control over the film thickness and stoichiometry is demonstrated. Perovskite films are optimized for the best device performance by varying parameters including evaporation rate, film thickness, and composition of the as-deposited perovskite layer.

As a result, CsPbBr3-based PeLEDs that exhibit narrow green emission significantly reduced leakage current; therefore, substantially improved brightness and efficiency were realized.

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Seeking summer internship.
PhD advised by Dirk Englund.
Available from June 2020.

Research Interests:
2D materials, communications, nanomaterials, nanotechnology, optoelectronics, photonics, sensors.

6.10

High Speed Roll-to-Roll Production of Atomically Thin (2D) Materials Using a Split Zone CVD Reactor

P. R. Kidambi, D. Mariappan, A. Vyatskikh, M. Feldmann, A. J. Hart

Sponsorship: MIT Energy Initiative, U. S. Department of Energy

Large-area applications of 2D materials such as membranes and barrier films require a means of cost-effective roll-to-roll manufacturing. We have designed and assembled a split zone CVD reactor for roll-to-roll synthesis of 2D materials by chemical vapor deposition (CVD). The reactor configuration consists of an annealing and growth zone separated by a narrow slit through which the catalytic flexible metallic substrate (foil) passes from one end of the reactor to the other. The design of this system was guided by flow simulations. Using the system constructed in our laboratory, we demonstrate synthesis of uniform, high quality graphene at speeds up to 500 mm/min, specifically for membrane and barrier applications. A detailed investigation into the process parameters that influence the growth of graphene on a moving substrate allows us to identify process optimization techniques for roll-to-roll synthesis and subsequent processing for manufacturing of films with tailored nanoscale porosity. We reflect on the scalability of this process and general principles for roll-to-roll CVD of other 2D materials.

Figure 1: Split zone CVD reactor for roll to roll production of 2D materials.