King Abdullah University of Science and Technology
at Thuwal, Kingdom of Saudi Arabia

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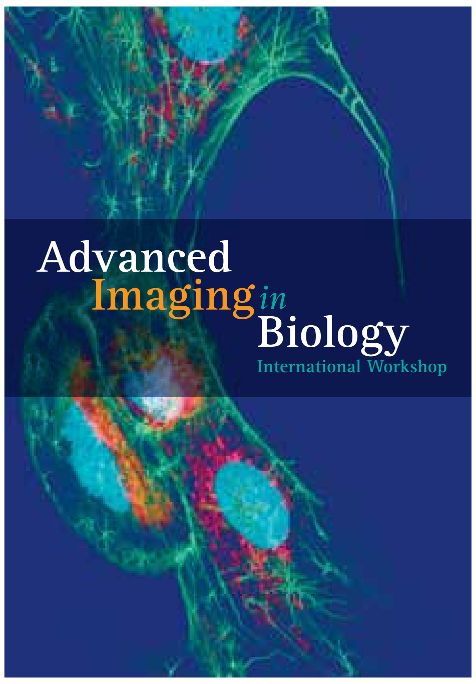

IMAGING WORKSHOP

KAUST HOSTED the first *International Workshop on Advanced Imaging in Biology* in November. The three-day workshop provided a forum for preeminent scientists from across the relevant disciplines in physics, biology, chemistry, and engineering. The multidisciplinary group came together to identify and promote scientific breakthroughs, innovative technologies, and novel applications of microscopy in bio- and nano-technologies.

Participants included eighteen international researchers, and invited colleagues from King Abdulaziz University, as well as KAUST faculty, staff, and students. One area of particular focus was the development of, and future applications for, state-of-the-art multi-modality imaging to tackle compelling questions related to the life sciences. Other presentations ranged from the use of digital holographic microscopy to explore neural cell dynamics, to new advances in super high-resolution microscopy that enables the visualization of single molecules at nanoscale. A popular item of discussion was the capability and potential of KAUST's world-class facilities, including the Advanced Nanofabrication, Imaging and Characterization Core Laboratory, which contains the electron microscopes and NMR suite, as well as the Advanced Computation & Visualization Facility.

The workshop was part of an initiative to support the establishment of strong competency in advanced bioimaging at KAUST, with the aim of expanding research programs in fields at the interface of technology and biology. This inaugural gathering of such a distinguished group of academics provided a forum for the exchange of ideas and discussion around potential collaborations in one of the focal research areas of the Division of Biological and Environmental Sciences and Engineering (BESE). It is anticipated that the *International Workshop on Advanced Imaging*

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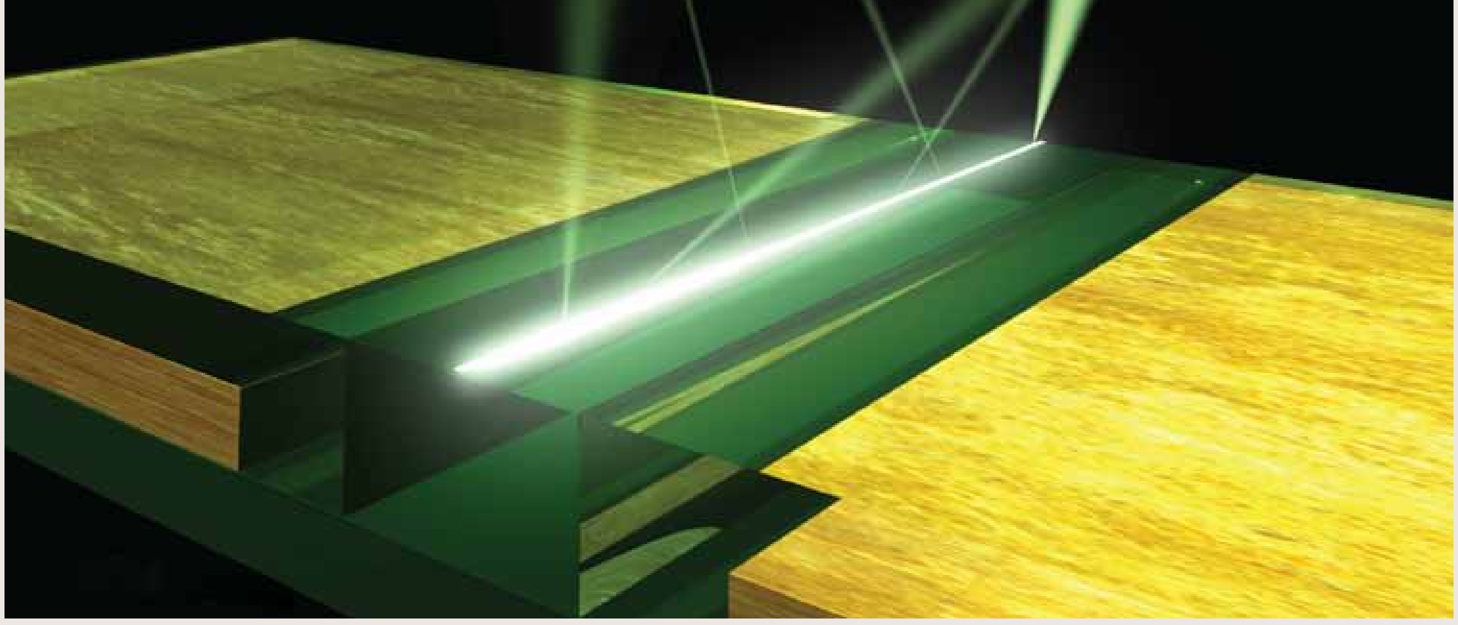
IRONING OUT THE KINKS IN ORGANIC TRANSISTORS

تقنية جديدة تزيل العوائق أمام الشحنات الكهربائية في أغشية الترانزستور

Professor Amassian's paper was selected to be featured on the cover of *Advanced Materials* on November 2, 2012. The art for this cover was created by Katya Mikhaylova, a scientific illustrator and artist who works for the Office of Academic Writing Services at KAUST.



"THE SPEED of electrical charges across the channel determines the response time of a thin film transistor (TFT), and essentially the speed of the display on your smartphone or e-book," explains Aram Amassian, Assistant Professor of Materials Sciences and Engineering. "For charges to move fast, such as in a video, the material they move through should not offer too many obstacles. One of the challenging questions for printed electronics has been how to print semiconductors on patterned surfaces without causing structural changes that can stifle TFT performance."

A new x-ray microbeam technology addresses this problem by providing a breakthrough in the way structural heterogeneities are studied within the channel of organic TFTs. The groundbreaking work was conducted by Dr. Ruipeng Li and Prof. Aram Amassian, the head of KAUST's Organic Electronics and Photovoltaics group, in a close collaboration with Dr. Detlef Smilgies of the Cornell High Energy Synchrotron Source (CHESS), as well as researchers from Wake Forest University (NC, US) and the University of Kentucky in Lexington (KY, US). The paper describing the research was published in *Advanced Materials* and is featured on the front cover of the November 2 issue of the journal.

"When printing an organic semiconductor on a patterned surface," Prof. Amassian says, "by definition, you initiate phase transformation in the presence of surface corrugations and chemical changes. One of the consequences is that the film can form undesirable polymorphs and crystal orientations." Researchers have long suspected that irregularities within the microstructure of the semiconductor film act as bottlenecks to slow down charge transport. "All of us suspected a problem but could not locate it and correlate it with any certainty," Prof. Amassian says. "This is where the new technique developed by Dr. Li came in very handy."

Dr. Li, one of KAUST's founding postdocs, joined the University from CHESS, where he specialized in synchrotron science. "Synchrotron is a very bright x-ray source," Dr. Li says. "We used a

ORGANIC TRANSISTORS | *Continued on p2*

يقول البروفسور أرام أماسيان، الأستاذ المساعد في علوم وهندسة المواد، أن سرعة الشحنات الكهربائية عبر القنوات تحدد زمن استجابة أغشية الترانزستور الرقيقة وبصورة جوهرية سرعة عرض المعلومات على شاشة الهواتف الذكية أو الكتب الالكترونية، ولكي تتحرك الشحنات بسرعة كما هو الحال في شريط الفيديو يجب أن لا توفر المادة التي تتحرك عبرها الكثير من العوائق. ويتمثل أحد الأسئلة المليئة بالتحديات بالنسبة للالكترونيات المطبوعة في كيفية طباعة أشباه الموصلات على الأسطح غير الملساء دون أن يترتب على ذلك تغيرات في البنية تؤدي إلى إعاقة أداء أغشية الترانزستور الرقيقة.

وتعالج تقنية جديدة للأشعة السينية الدقيقة هذه المشكلة من خلال أحداث اختراق في الطريقة التي تتم بها دراسة التركيبات المتجانسة داخل قناة من أغشية الترانزستور العضوية. وقد قام بهذا العمل الجديد والمبتكر الدكتور رويبنق لي مع البروفسور أرام أماسيان، رئيس مجموعة الالكترونيات والخلايا الضوئية العضوية في جامعة الملك عبدالله للعلوم والتقنية، بالتعاون الوثيق مع الدكتور ديتلف سميلقيز، من كورنيل هاى إنرجي سينكروترون سورس وباحثين من جامعة ويك فورست وجامعة كنتكي في ليكسنكتون. وتم نشر الورقة التي تصف هذا البحث في مطبوعة «Advanced Materials» وفي صفحة الغلاف من عدد نوفمبر.

ويقول البروفسور أماسيان أنه عند طباعة أشباه موصلات عضوية على أسطح خشنة فإن الشخص يشرع بصورة بديهية في عملية التحول المرحلية بسبب وجود التعرجات السطحية والتغيرات الكيميائية. وأحد النتائج المترتبة على ذلك هي أن الغشاء يمكن أن ينتج أشكالاً متعددة غير مرغوبة وتشكل البلورات.

وقد شك الباحثون منذ مدة طويلة أن عدم انتظام السطح داخل الهيكل الميكرسكوبي لغشاء أشباه الموصلات يعمل كخانق يؤدي إلى إبطاء عملية انتقال الشحنة. ويقول البروفسور أماسيان إنهم جميعا شكوا في وجود مشكلة ولكنهم لم يتمكنوا من تحديدها وربطها بأي قدر من اليقين ومن هنا كانت فائدة الأسلوب الجديد الذي طوره الدكتور لي.

والدكتور لي هو أحد الباحثين المؤسسين لما بعد مرحلة الدكتوراه في جامعة الملك عبدالله وقد قدم إليها من (كورنيل هاى إنرجي سينكروترون سورس) حيث تخصص في علوم اشعاع السنكترون. ويصف الدكتور لي هذا الإشعاع بأنه مصدر لامع للغاية للأشعة السينية وأنهم يستخدمون شعيرة رقيقة جدا لتركيز الأشعة السينية على نقطة من مقاس أصغر بكثير من الترانزستور. ويقول إنه من خلال الجمع بين أشعة سينية متغيرة مع مجهر بصري وأجهزة كشف أشعة سينية ثنائية الأبعاد عالية السرعة أصبحوا الآن في وضع يمكنهم من تشكيل خريطة دقيقة التفاصيل لأشباه الموصلات في العشرات من الأجهزة المطبوعة دون إتلافها أو اصابتها بأي ضرر.

تتمه صفحة 2

THE START of the new Hijri year brings with it the promise of cooler weather and natural pause for reflection. These kinds of moments are welcomed amidst the day-to-day challenges of developing the University, as it is sometimes possible to lose sight of the remarkable progress our students, researchers, and faculty members are making in fulfilling KAUST's fundamental research mission.

With each issue, *The Beacon* offers a glimpse into the exciting research, activities, and scientific work currently taking place.

This month, we offer stories about work on thin film transistors and a new geophysical method to measure the tensile strength of rock, the recent international workshop on advanced imaging in biology, and our latest SABIC postdoctoral winners. We also focus on the accomplishments of our students, who are the heart of our University, with news on the results of the 2012 Dow Sustainability Innovation Challenge and highlights of student papers from across all academic divisions. ☐

—THE BEACON Editorial

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SUNSET CONCERT MUSICIANS

IN BRIEF

SUNSET CONCERT

THE VIEW of the setting sun created a perfect backdrop to the second Sunset Concert of the academic year, when musicians serenaded a packed crowd at the University Library on October 13.

Jessica Bouwmeester, PhD candidate, BESE, violin; her brother, Daniel Bouwmeester, guest artist, TUDelft, the Netherlands, clarinet; and Eduardo Regula, TKS ECC Performing Art teacher, piano, performed Trio 2 in A minor by C.P.E. Bach followed by Regula on the piano playing Schumann's lovely *Phantasiestucke Op. 12 No.1, Der Abends*.

Bass/baritone Wassim W. Ayass, MS candidate, PSE, accompanied on piano by Regula, transported the audience to mid-twentieth century France with Edith Piaf's "La Vie En Rose," and then wowed the audience with Paride's aria, "O del mio dolce ardor," from Gluck's opera, *Paride and Elena*.

The evening closed with a series of foot-tapping Swiss folk songs. The two Bouwmeesters on clarinet and violin were joined by Wendy Keyes, Coordinator of Arts Programming, viola; Ann Scott, MS candidate, CEMSE, double bass; and Aloysius Wong, PhD candidate, BESE, piano, transporting the audience to the mountains of Europe. ☐

Conferral of Toastmaster Plaque to Osamah Fakieh presented by former Area Governor Abdullah Niaz

A TOAST FROM THE KAUST TOASTMASTERS

IN OCTOBER, Klemens Katterbauer, president of KAUST's Al-Manarah Toastmasters Club, joined with other local Toastmasters presidents to thank Osamah Fakieh, Petro Rabigh's Vice President of Human Resources, for the support he has given to the KAUST club and others in the region. Mr. Fakieh's practical support and encouragement to the Rabigh area Toastmasters clubs has helped further their development and expand overall membership since 2008.

Toastmasters International is a worldwide nonprofit organization that helps club members improve their public speaking and leadership skills. The KAUST chapter of Toastmasters currently has 25 members and was formed in 2009 as the very first student-led group on campus. ☐

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very thin capillary to focus x-rays to a spot size much smaller than the transistor; combining the high flux x-ray beam with an optical microscope and fast 2D x-ray detectors, we are now in a position to stitch together a detailed microstructural map of the semiconductor in dozens of printed devices without destroying them."

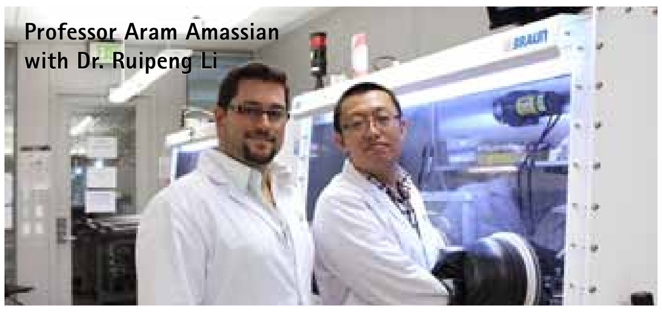
With the newly developed tools, the researchers were able to identify the source of the defects and correlate them to device performance. The team from Wake Forest subsequently demonstrated improved device performance by addressing the structural irregularities identified by the KAUST team.

"We're very excited about the next steps of this collaborative project", says Prof. Amassian. "The high-speed imaging capabilities of Prof. Sigurdur Thoroddsen's group have emerged as a particularly powerful way to watch as semiconductors crystallize on patterned surfaces!" ☐

تابع ص1

وباستخدام الأدوات التي تم تطويرها مؤخرا تمكن الباحثون من التعرف على مصدر العيوب وربطه بأداء الأجهزة. وقد عرض الفريق من ويك فورست أجهزة ذات أداء محسن من خلال معالجة عدم الانتظام الذي اكتشفه فريق جامعة الملك عبدالله.

ويقول البروفسور أماسيان إنهم يشعرون بالإثارة إزا ء الخطوات التالية لهذا المشروع التعاوني. وقد برزت امكانيات التصوير عالي السرعة التي وفرتها مجموعة البروفسور سيقوردور ثورودسون كوسيلة فعالة لمشاهدة تحول أشباه الموصلات إلى بلورات على الأسطح الخشنة. ☐

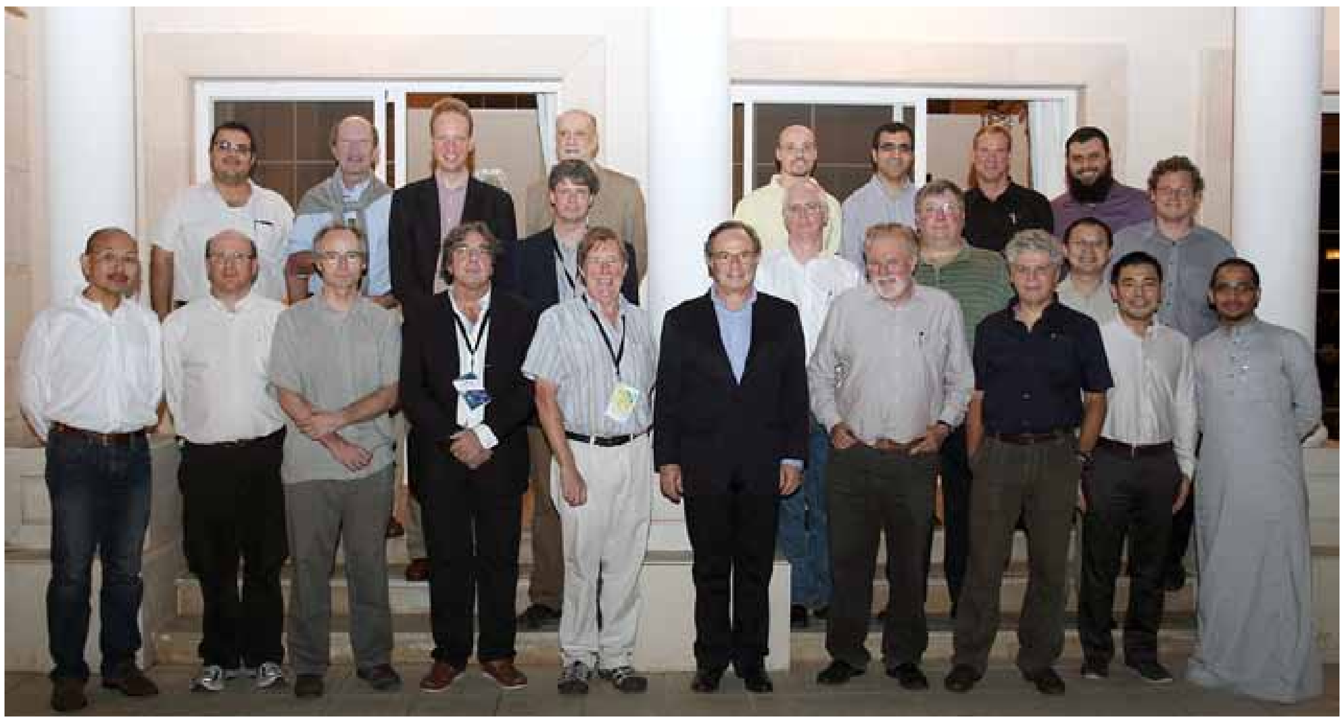


Professor Aram Amassian with Dr. Ruipeng Li

IMAGING WORKSHOP | Continued from p1

will provide the platform for pioneering research and technology development in cellular and molecular imaging.

The event was jointly organized by Professors Pierre Magistretti, Dean of BESE; Colin Sheppard of National University of Singapore; and Christian Depeursinge of École Polytechnique Fédérale de Lausanne. ☐



LEFT TO RIGH BACK ROW: MOHAMAH YASSIN SAKA, KING ABDULAZIZ UNIVERSITY (KAU); MATHIAS FINK, ÉCOLE SUPÉRIEURE DE PHYSIQUE ET DE CHIMIE (ESPC); PETER NELLIST, OXFORD UNIVERSITY; CLAUDE BOCCARA, ESPC; PIERRE MARQUET, UNIVERSITY OF LAUSANNE; SAMIR HAMDIN, KAUST; BENNETT GOLDBERG, BOSTON UNIVERSITY (BU); ADNAN MEMIC, KAU

MIDDLE ROW: RAINER HEINTZMANN, JENA UNIVERSITY; KEITH NUGENT, UNIVERSITY OF MELBOURNE; ERNST STELZER, GOETHE UNIVERSITY; QINGMING LUO, HUAZHONG UNIVERSITY; YVES DE KONINCK, LAVAL UNIVERSITY

FRONT ROW: PETER SO, MASSACHUSETTS INSTITUTE OF TECHNOLOGY; PAUL CAMPAGNOLA, UNIVERSITY OF WINCONSIN; JERMONE MERTZ, BU; ALBERTO DIASPRO, INSTITUTO ITALIANO DI TECHNOLOGIA (IIT); COLIN SHEPPARD, IIT; PIERRE MAGISTRETTI, KAUST; CHRISTIAN DEPEURSINGE, ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE; ENZO DI FABRIZIO, IIT; SATOSHI HABUCHI, KAUST; MUSAB ALZEHRI, KAU

ATTENDEES NOT IN PHOTO: ADEL CHAUDHARY, KAU; FARID AHMED SYED TAHA YASIN, KAU; PAUL MATSUDAIRA, NATIONAL UNIVERSITY OF SINGAPORE

WINTER ENRICHMENT PROGRAM (WEP) 2013

November 19: Schedule posted online at wep.acadox.com
November 19: Presentation and registration for students: Auditorium (building 20), 12:45-2:45 p.m
November 23: Science Fun Fair proposal deadline
November 28: WEP registration opens for the KAUST community

Take time to register for the exciting events and fascinating lectures offered at WEP 2013!