



MATERIALS NEWS

UCSD Materials Science & Engineering Newsletter

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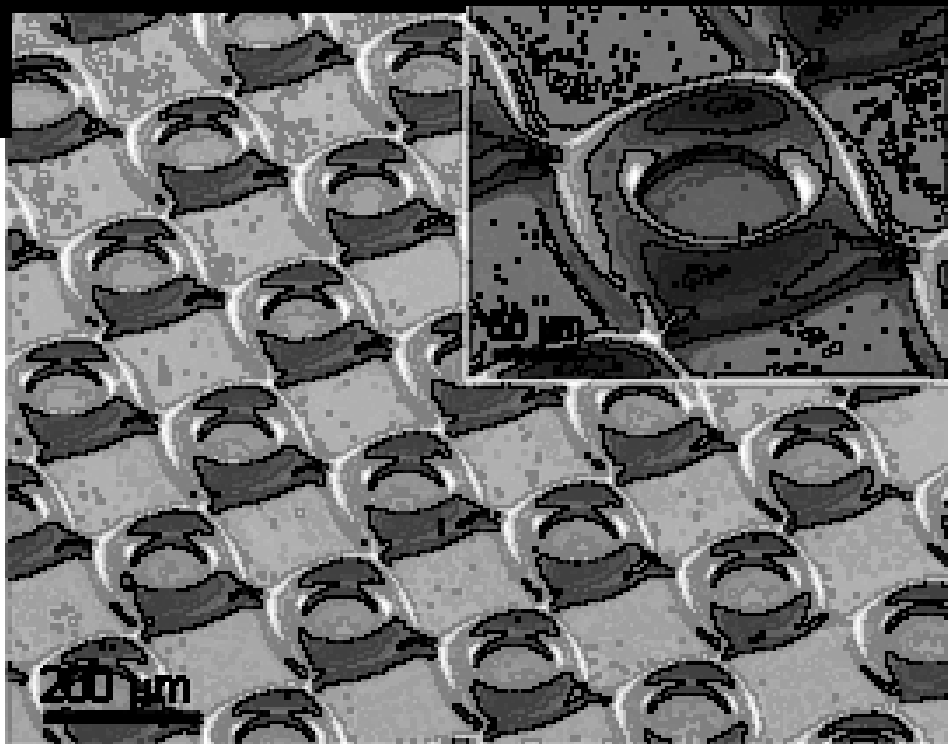
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Piezo-electric materials such as barium titanate or lead zirconate titanate offer the most direct way of converting mechanical energy into an electrical potential or vice versa. However, piezoelectrics are intrinsically low power density materials and it has been difficult to boost the performance of these materials. To address these, the Sirbuly group has been developing technologies that couple piezoelectric nanostructures to polymer matrices to maintain processability and biocompatibility while introducing new strategies to funnel mechanical energy to the piezoelectric crystal. The group, in collaboration with another materials science & eng professor Shaochen Chen, recently demonstrated a 3D optical printing technique, based on digital projection printing (DPP), that can photopolymerize piezoelectric nanoparticle-polymer colloidal solutions into user-defined 2D or 3D structures in mere seconds. *continued on Page 3...*

LETTER FROM THE DIRECTOR

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The Materials Science & Engineering

(MSE) Program at UC San Diego is a university-wide, highly interdisciplinary program with more than 90 participating UCSD faculty members and ~170 graduate students among which ~130 are PhD students. The professors and students in our program come from various divisions of UCSD, including the Jacobs School of Engineering (Departments of Electrical and Computer Engineering, Mechanical and Aerospace Engineering, Structural



Engineering, Bioengineering, Nano-engineering), Division of Physical Sciences (Department of Physics, Department of Chemistry & Biochemistry), Division of Biological Sciences, the School of Medicine, and the School of Pharmacy.

Our MSE faculty members are mostly outstanding in their research and education career, with the faculty now including 8 National Academy of Engineering, 5 National Academy of Sciences, 3 Institute of Medicine members, and the prestigious National Medal of Science Awards in recent years to Prof. Shu Chien and Prof. Marye Anne Fox who are also our MSE members. Having such an excellent quality of faculty, combined with one of the highest per faculty research grants in the nation, provides a stimulating environment for our graduate students working toward their MS and PhD degrees.

In addition to the classroom lectures curriculum, we have now added cleanroom technique training for all new incoming students for lithography, nanofabrication, SEM microscopy and thin film deposition. Lab training of our students on biological research including cell culture and bioassay techniques is also being planned. UCSD's Materials Science & Engineering (MSE) is ranked 14th among all Materials Science doctoral programs in the United States by the prestigious National Research Council (NRC) data-based assessment. I am always proud of our faculty and graduate students in the MSE program for their enthusiasm toward high quality education and research. With future newsletters, we will continue to share the latest information on academic, research, and career progress of our faculty, students, postdocs, and alumni from our MSE Program.

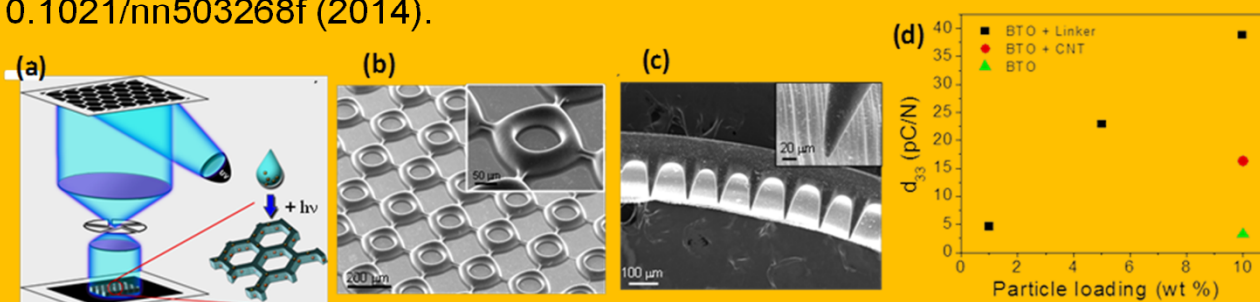


Sungho Jin

Director, UCSD Materials Science & Engineering Program
Distinguished Professor of Materials Science

3D Optical Printing of Piezoelectric Polymers...continued from page 1

The piezoelectric nanocrystals crosslink with the polymer chains under light exposure and significantly enhance the mechanical-to-electrical conversion process. In fact, piezoelectric charge coefficients on the order of 40 pC/N were measured from the optically printed materials with only 10% mass loading of BTO nanoparticles. These values are already higher than pure piezoelectric polymers such as polyvinylidene fluoride (PVDF) and approaching that of monolithic BTO films. This chemical interface between the piezoelectric nanoparticle and polymer matrix is critical for designing highly sensitive piezoelectric polymers that can outperform their brittle electroceramic counterparts. This along with the ability to create 3D structures should have far reaching impact in materials science and engineering. The details are described in a recently published article, K. Kim, W. Zhu, X. Qu, C. Aaronson, W.R. McCall, S. Chen, and D.J. Sirbully, "3D Optical Printing of Piezoelectric Nanoparticle-Polymer Composite Materials" *ACS Nano*, Article ASAP, DOI: 10.1021/nn503268f (2014).

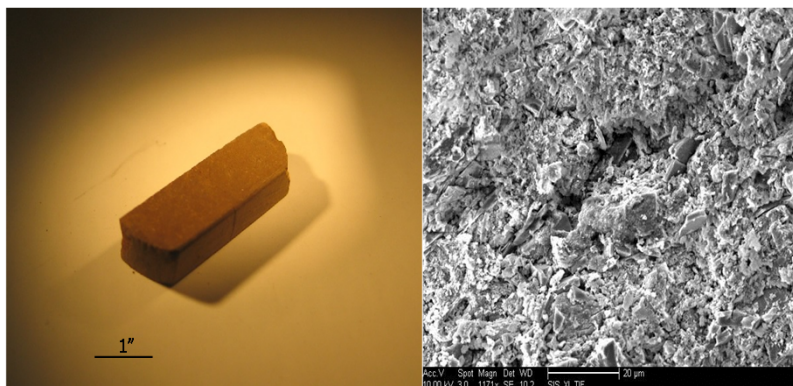


(a) Schematic of a DPP setup that generates dynamic digital masks on the photoliable piezoelectric-polymer composite solution. (b-c) Electron micrographs of a 2D square array and 3D tapered cantilever array, respectively, fabricated using DPP. (d) Piezoelectric charge coefficient as a function of particle loading. The BTO nanoparticles functionalized with the crosslinkable chemical groups significantly outperform composites with carbon nanotube fillers or unmodified BTO nanoparticles.

Discovery: A certain type of minerals on Mars

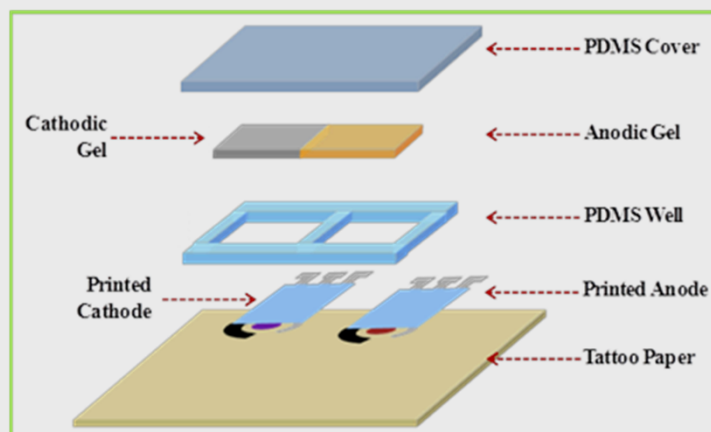
NASA plans to send humans to the Mars by 2030, and there is an urgent need to develop enabling technologies for space colonization. A crucial stepping stone is the processing of infrastructural materials based on locally harvestable resources, e.g. martian regolith. In a recent research on martian soil simulants, Dr. Qiao's team had an exciting discovery: A certain types of minerals that are ample on the Mars, such

as oxides decorated with basaltic grains and a few semitic clays, can be directly compacted into "bricks" without calcination/heating. The processing procedure is water free, one-stepped, and quite energy efficient. The flexure strength of such "bricks" can be higher than that of regular clay bricks by nearly an order of magnitude. Key processing parameters include compaction pressure, grain size gradation, etc. The research goals straddle the promise of allowing economical and self-sustainable production of martian structural materials with minimum requirement on space transportation, critical to expansion, maintenance, and fabrication of martian bases, outposts, as well as structural components in large-sized space telescopes and interferometers, landing and launch platforms, storage and waste disposal units, volatiles recycling systems, solar or nuclear power plants, to name a few.

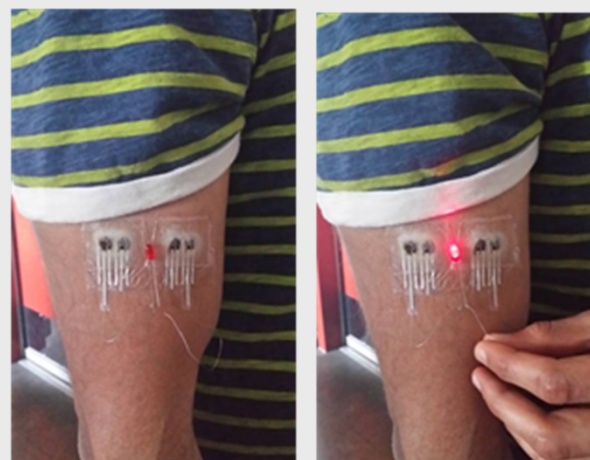


Wearable Batteries...

Two MatSci program professors: Prof. Joseph Wang and Prof. Shirley Meng's groups at Department of NanoEngineering have demonstrated a rechargeable, printable battery for wearable electronic devices such as heart rate and other health/fitness monitors. The battery's electrodes are screen-printed using a special ink. Negative and positive electrodes are arranged laterally which enables researchers to integrate several cells into a battery to scale up the power. A single cell generated 1.5V and stays stable for days in open air. The battery can be worn on the skin without any special protective casing. Lab tests showed that the battery performed effectively even while being bent and stretched from the subject's movement. Their findings were published in the *Journal of Materials Chemistry A*, coauthored by S. Berchmans, A. Bandodkar, W. Jia, J. Ramirez, Y. S. Meng and J. Wang, "An epidermal alkaline rechargeable Ag-Zn printable tattoo battery for wearable electronics", 2014, 2(38), 15788. This is the first report on the fabrication of a rechargeable, non toxic, Ag-Zn tattoo battery using unconventional substrates such as tattoo paper substrates, alkaline gel electrolytes and a PDMS cover for sealing the battery which can be transferred on to the skin at ease without the need for special carriage for housing the battery constituents.

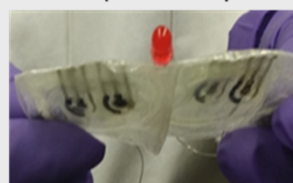


Schematic diagram illustrating the different steps involved in the fabrication of the Ag-Zn cell



Demonstration of practical utility of the tattoo battery for lighting a red LED after transfer onto skin

LED "OFF" (180° Bend)

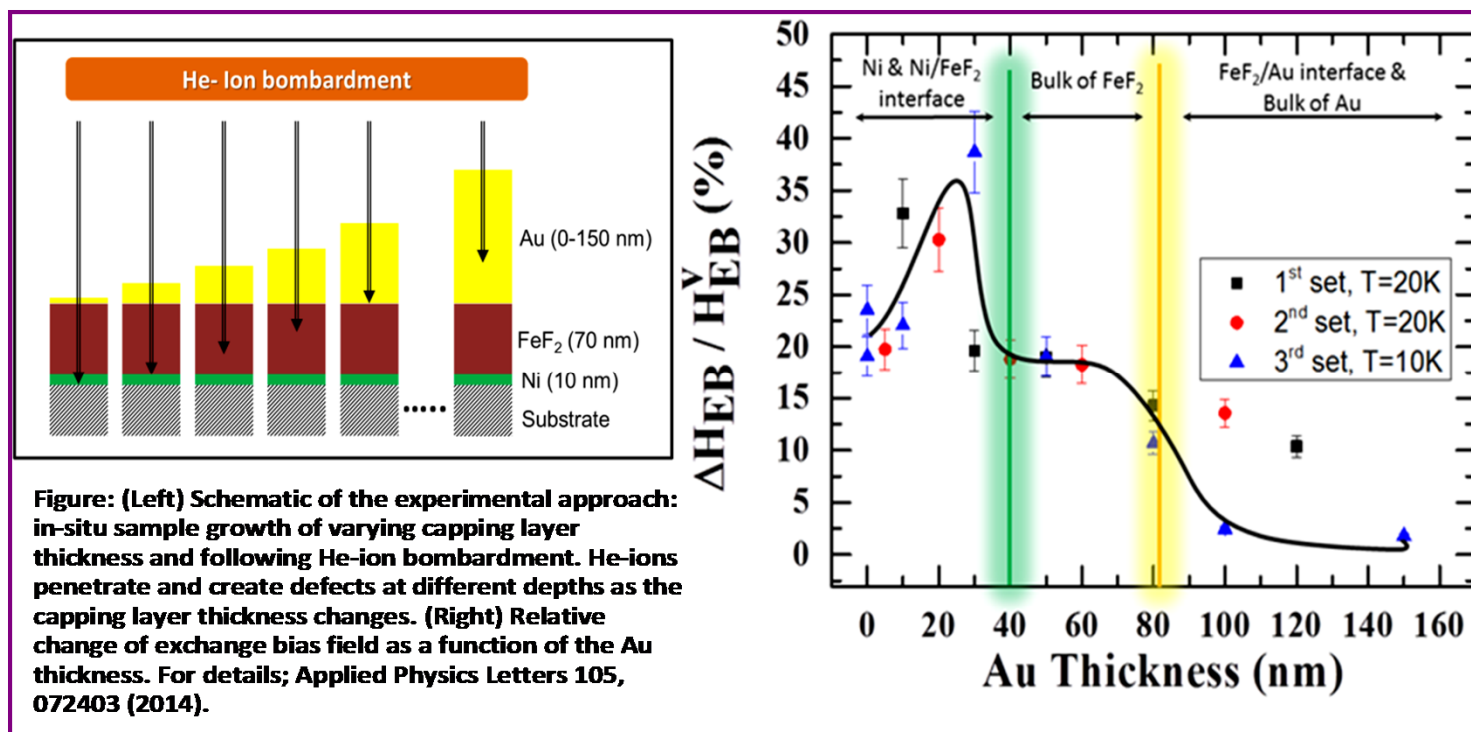


LED "ON" (180° Bend)



Demonstration of the performance of the tattoo battery under deformed conditions.

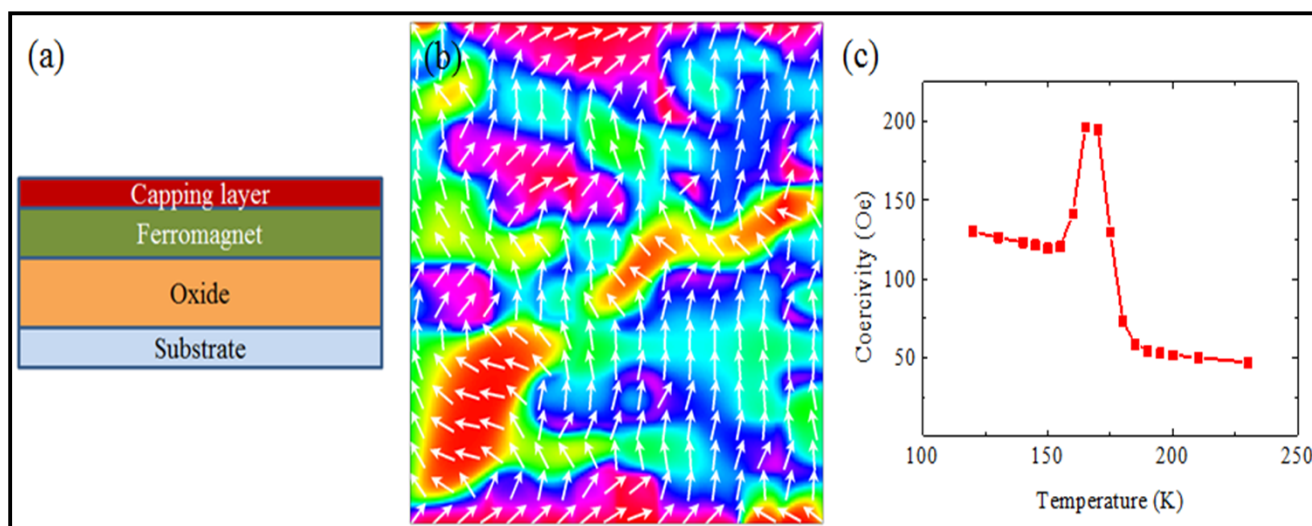
Exchange bias at the nanoscale: bulk or interface?



Magnetism has had many applications through-out history. One of the earliest was compasses, which dramatically improved open sea navigation. Today, magnetism-based devices have superseded Cuneiform Scripts, pen and paper, and even print as the principle methods of recording. One of the key ingredient in magnetic devices is the so called exchange bias phenomenon. Although the application of the exchange bias effect in the current sensor and storage technologies is widespread, the understanding of the mechanism is still elusive. Understanding it, may lead to further improvements on the technology.

Ali Basaran, a MSE graduate student in Prof. Ivan K. Schuller group, has performed a clear cut experiment to address directly a crucial issues in exchange bias phenomenon: the dependence of exchange bias on interfacial and bulk magnetic spins. They employed ion bombardment to create controlled defects at known locations and separate individual contributions from the interface and bulk. The study shows remarkably that the exchange bias is significantly affected by the defects created in the bulk - even without defect creation at or near the interface. Since many theories consider exchange bias to be only an interfacial property and several contradictory experimental results exist, these study clarifies one of the long-standing controversies in magnetism. The work has been published in *Applied Physics Letters* 105, 072403 (2014).

Control of Magnetism in Oxide/Magnetic Heterostructures



(a) Oxide/ferromagnet hybrid structure. (b) Micromagnetic simulation of the ferromagnetic domain structure. (c) Temperature dependence of the coercivity.

One of the important basic research issues, with important implications in the magnetic recording technology, is the control of the magnetic coercivity with external stimuli including heat, microwave, stress, and etc. Recently, Siming Wang an MSE graduate student in Prof. Ivan K. Schuller's group, proposed a new control concept of magnetism using oxide/ferromagnet heterostructures (Fig. 1(a)) in which the oxide undergoes a phase transitions.

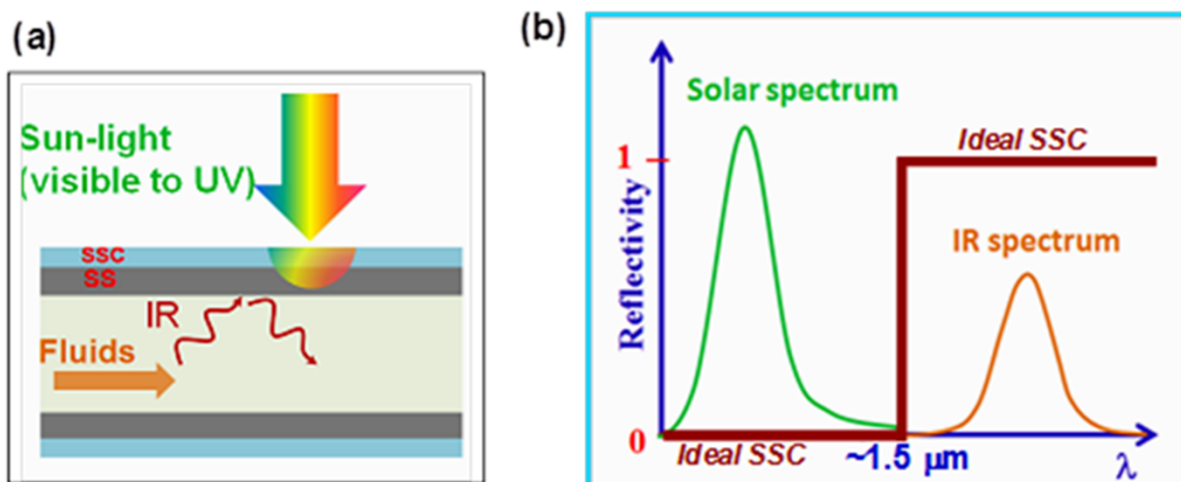
Vanadium oxides are members of the prototypical transition metal oxide family that exhibit structural phase transitions with a broad range of transition temperatures which can be tuned with stoichiometry, stress, doping, etc. The first order structural phase transition of vanadium oxides is inhomogeneous, i.e. two different crystal structures coexist as the transition takes place. This inhomogeneity induces magnetic domain wall pinning (Fig. 1(b)) in the ferromagnets and may increase the coercivity by as much 300% within a narrow temperature range of 15 K (Fig. 1(c)) unlike any other ferromagnet. This basic research can open up a new avenue for the coercivity control in magnetic recording media.

This present work was published in "Coercivity enhancement in V_2O_3/Ni bilayers driven by nanoscale phase coexistence", by J. de la Venta, Siming Wang, T. Saerbeck, J. G. Ramirez, I. Valmianski, and Ivan K. Schuller, *Appl. Phys. Lett.* **104**, 062410 (2014).

New Solar Thermal Absorber for Concentrating Solar Power Generation

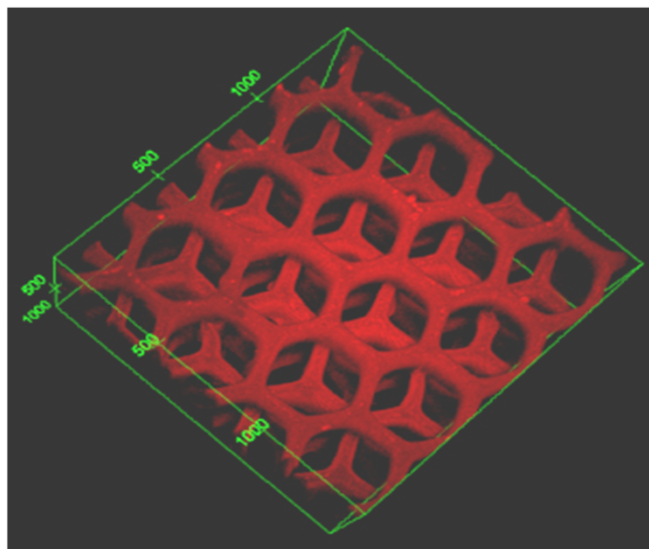
Solar energy can potentially play a significant role for a clean, renewable, global energy supply. In addition to the direct solar-electricity conversion using photovoltaic (PV) solar cells, the concentrating solar power (CSP) plants generate electricity from solar thermal energy via steam turbine engines. Despite PV technology's rapid development, CSP still offers several unique advantages such as high energy-conversion efficiency, thermal energy storage capability, and the potential to retrofit current coal power plants. More than ~20 GW of CSP plants are under development world-wide. Among the various components in a CSP system, the solar absorber that receives the concentrated solar energy plays a critical role in overall system performance. To increase the Carnot efficiency of the power generation system, it is desirable that the CSP operation temperature is 600C or higher. In order to increase the temperature of the receiver, a solar absorber has to maximally absorb solar energy while minimizing losses due to blackbody emission.

Spectrally Selective Coatings (SSCs) are a critical component that enables high-temperature, high-efficiency operation of CSP systems. New bandgap-adjusted semiconductor nanoparticle materials with efficient solar thermal energy absorption in the VIS-NIR regime but with minimal IR blackbody radiation loss have been developed in a joint research effort by three materials science faculty groups at UCSD (Profs. Renkun Chen, Zhaowei Liu, and Sungho Jin) for enhanced UV-VIS absorption but with minimal IR emission loss at desirably high operating temperature. [Jaeyun Moon, Dylan Lu, Bryan VanSaders, Tae Kyoung Kim, Seong Deok Kong, Sungho Jin, Renkun Chen and Zhaowei Liu, "High performance multi-scaled nanostructured spectrally selective coating for concentrating solar power", *Nano Energy* **8**, 238-246 (2014), and Tae Kyoung Kim, Jaeyun Moon, Bryan VanSaders, Dongwon Chun, Calvin J. Gardner, Jae-Young Jung, Gang Wang, Renkun Chen, Zhaowei Liu, Yu Qiao, and Sungho Jin, Si Boride-Coated Si Nanoparticles with Improved Thermal Oxidation Resistance, *Nano Energy* **9**, 32-40 (2014).]



(a) Concentrating solar power receiver structure, (b) Reflectivity behavior of ideal spectrally selective coating for maximal absorption of solar spectrum visible+NIR light and minimal black-body IR loss.

Bioprinting a 3D Liver-Like Device to Detoxify the Blood



3D-printed device inspired by the liver to remove dangerous toxins from the blood.

Nanoengineers and materials scientists at the University of California, San Diego have developed a 3D-printed device inspired by the liver to remove dangerous toxins from the blood. The device, which is designed to be used outside the body -- much like dialysis -- uses nanoparticles to trap pore-forming toxins that can damage cellular membranes and are a key factor in illnesses that result from animal bites and stings, and bacterial infections. Their findings were published May 8 in the journal *Nature Communications*.

Nanoparticles have already been shown to be effective at neutralizing pore-forming toxins in the blood, but if those nanoparticles cannot be effectively digested, they can accumulate in the liver creating a risk of secondary poisoning, especially among patients who are already at risk of liver failure. To solve this problem, a research team led by nanoengineering professor Shaochen Chen created a 3D-printed hydrogel matrix to house nanoparticles, forming a device that mimics

the function of the liver by sensing, attracting and capturing toxins routed from the blood.

The device, which is in the proof-of-concept stage, mimics the structure of the liver but has a larger surface area designed to efficiently attract and trap toxins within the device. In an in vitro study, the device completely neutralized pore-forming toxins. "One unique feature of this device is that it turns red when the toxins are captured," said the co-first author, Xin Qu, who is a postdoctoral researcher working in Chen's laboratory. "The concept of using 3D printing to encapsulate functional nanoparticles in a biocompatible hydrogel is novel," said Chen. "This will inspire many new designs for detoxification techniques since 3D printing allows user-specific or site-specific manufacturing of highly functional products," Chen said.

Chen's lab has already demonstrated the ability to print complex 3D microstructures, such as blood vessels, in mere seconds out of soft biocompatible hydrogels that contain living cells.

Chen's biofabrication technology, called dynamic optical projection stereolithography (DOPsL), can produce the micro- and nanoscale resolution required to print tissues that mimic nature's fine-grained details, including blood vessels, which are essential for distributing nutrients and oxygen throughout the body. The biofabrication technique uses a computer projection system and precisely controlled micromirrors to shine light on a selected area of a solution containing photo-sensitive biopolymers and cells. This photo-induced solidification process forms one layer of solid structure at a time, but in a continuous fashion. The technology is part of a new biofabrication technology that Chen is developing under a four-year, \$1.5 million grant from the National Institutes of Health (R01EB012597). The project is also supported in part by a grant (CMMI-1120795) from the National Science Foundation.

Bioinspired outer space sampler based on the Aristotle's Lantern in sea urchins

One focus of research in the McKittrick Group is bio-inspired design, an emerging field in mechanical engineering and materials science, which takes inspiration from nature to develop high-performance materials and devices. Graduate student Michael Frank, collaborating with Prof. Jennifer Taylor, post-doc Maya DeVries, Prof. Lisa Levin and graduate student Kirk Sato at SIO, are investigating the sea urchin's chewing organ, Aristotle's lantern. This organ opens when protruding outwards and closes when retracting inwards for simultaneous cut off and enclosure of their food in a continuous motion. High-resolution micro-computed tomography (micro-CT) images of the sea urchin and Aristotle's lantern were obtained via x-rays to create cross sections, then reconstituted and manipulated in 3-D space (Fig. 1). The Aristotle's lantern serves as bio-inspiration for our development of a geological sampling device. Currently, the Mars rover, Curiosity, has aluminum wheels, which have incurred significant damage from traversing over wind-sharpened rocks in craters and on mountainsides. We propose a Mars mini-rover installed with our bioinspired sampling device, which could collect more samples over a wider area for the main rover to analyze using its sophisticated onboard instrumentation (Fig. 2).

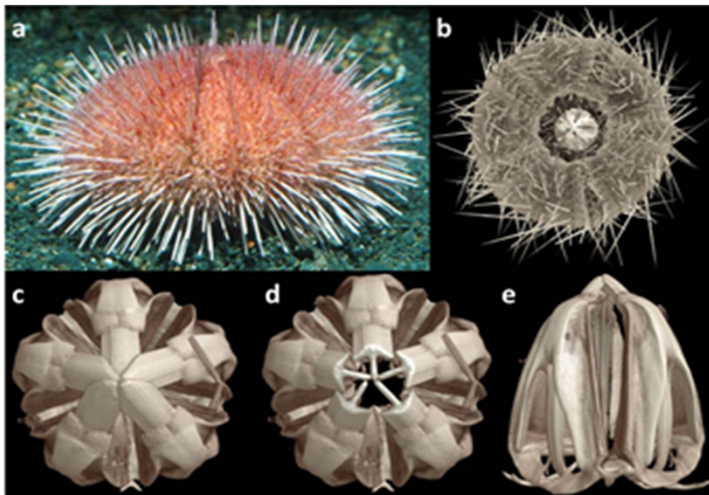


Fig 1. (a) Photograph of a sea urchin (*Strongylocentrotus fragilis*). (b) Micro-CT images of the urchin with Aristotle's lantern (mouth) visible in the center (ventral view). Close-up of (c) the five teeth stacked on top of each other. (d) Distal portions of the teeth are removed to show the orthogonally attached keels underneath. (e) A side view shows the outer pyramid structures, which support the teeth inside.

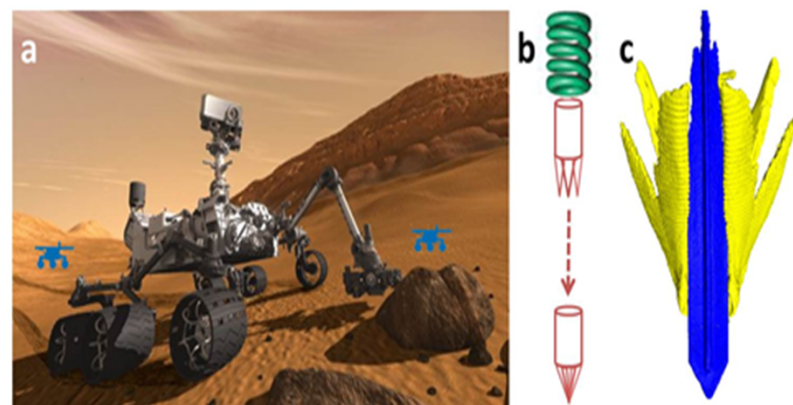
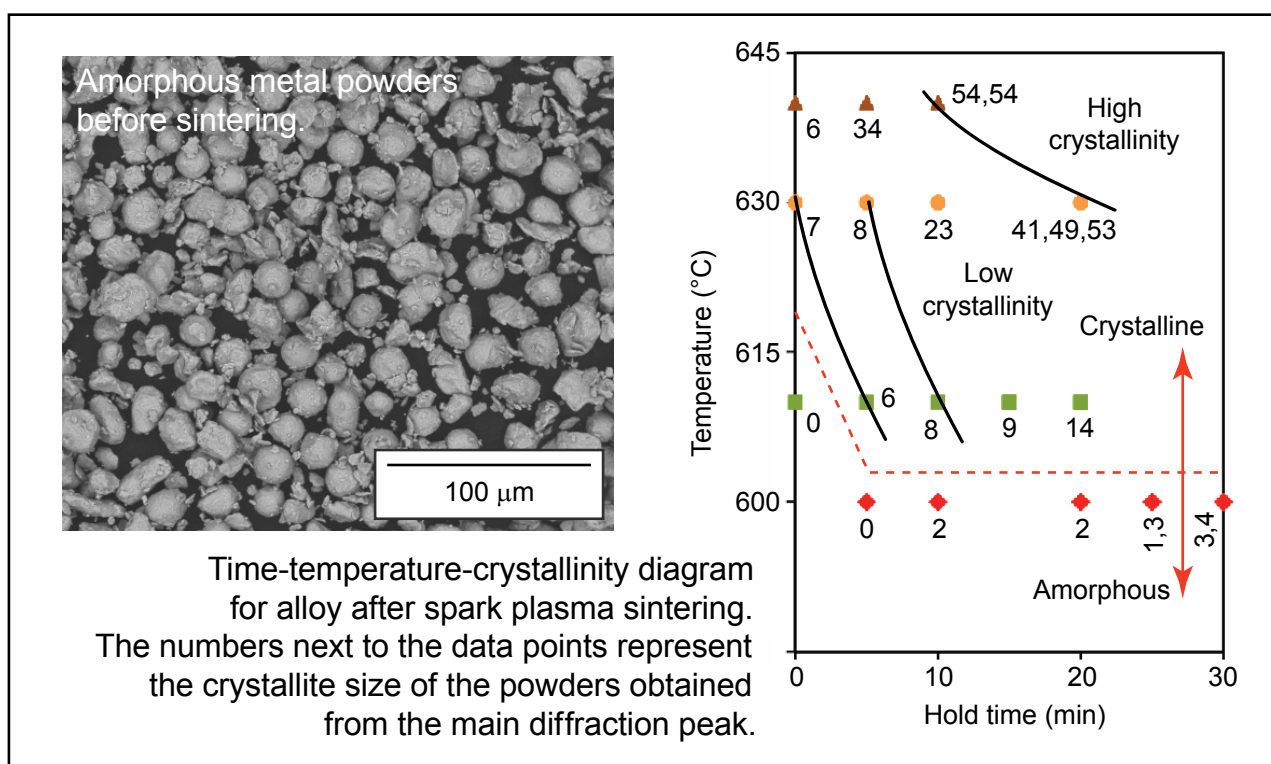


Fig 2. (a) Mars 2020 rover with sample collecting mini-rovers (blue) in background. (b) Drawing of compression spring loaded sampling mechanism. (c) Development of a bioinspired Aristotle's lantern tooth (blue) with pyramid (yellow) for 3-D printing.

Stability of Spark Plasma Sintered Metallic Glasses



Prof. Olivia Graeve's group with materials science graduate students has been working on the stability of metallic glasses during spark plasma sintering. The results are of two-fold interest. Firstly, they have defined an exponential relationship between crystallite size, time, and temperature of sintering. Secondly, they have proposed the concept of a TTC diagram (see figure) that can serve as a roadmap for determining changes in amorphous character with respect to time and temperature in metallic glasses.

Continued development of these TTC diagrams is useful for predictive purposes and for guidance on the spark plasma sintering of amorphous metals. This diagram is much easier to obtain for the case of fast sintering (i.e., spark plasma sintering) of metallic glasses, since no lengthy and tedious thermal analysis experiments are required, which in any case might not be representative of the fast sintering process during spark plasma sintering. The analysis provides an empirical framework for the study of amorphous metals by spark plasma sintering and can predict development of crystallite size as time and temperature of sintering are modified. This work is an important step towards a comprehensive understanding of the spark plasma sintering process in regards to its standardization for commercial viability.

Unusually High Optical Transparency in Hexagonal NanoPatterned Graphene with Enhanced Conductivity

Graphene has received much attention for its potential applications in flexible conducting film due to its exceptional optical, mechanical and electrical properties. However increasing transmittance of graphene without sacrificing the electrical conductivity has been difficult. In recent research carried out a Materials Science & Engineering graduate students including Paul Duyoung Choi, a successful fabrication of optically highly transparent ($\sim 98\%$) graphene layer having a reasonable electrical conductivity by nano-patterning and doping. Anodized aluminum oxide nanomask prepared by facile and simple self-assembly technique was utilized to produce an essentially hexagonally nano-patterned graphene (NPG). The electrical resistance of the graphene increases significantly by a factor of ~ 15 by removal of substantial graphene regions via nano-patterning into hexagonal array pores. However, our use of chemical doping on the nanopatterned graphene almost completely recovers the lost electrical conductivity, thus leading to a desirably much more optically transparent conductor having ~ 6.9 times reduced light blockage by graphene material without much loss of electrical conductivity. It is likely that the availability of large number of edges created in the nano-patterned graphene provides ideal sites for chemical dopant attachment, leading to a significant reduction of the sheet resistance R_S . The results indicate that the nano-patterned graphene approach can be a promising route for simultaneously tuning the optical and electrical properties of graphene to make it more light-transmissible and suitable as a flexible transparent conductor.

This research was conducted by graduate students Duyoung Choi and Cihan Kuru, and a postdoctoral researcher Dr. Chulmin Choi in Prof. Sungho Jin's group.

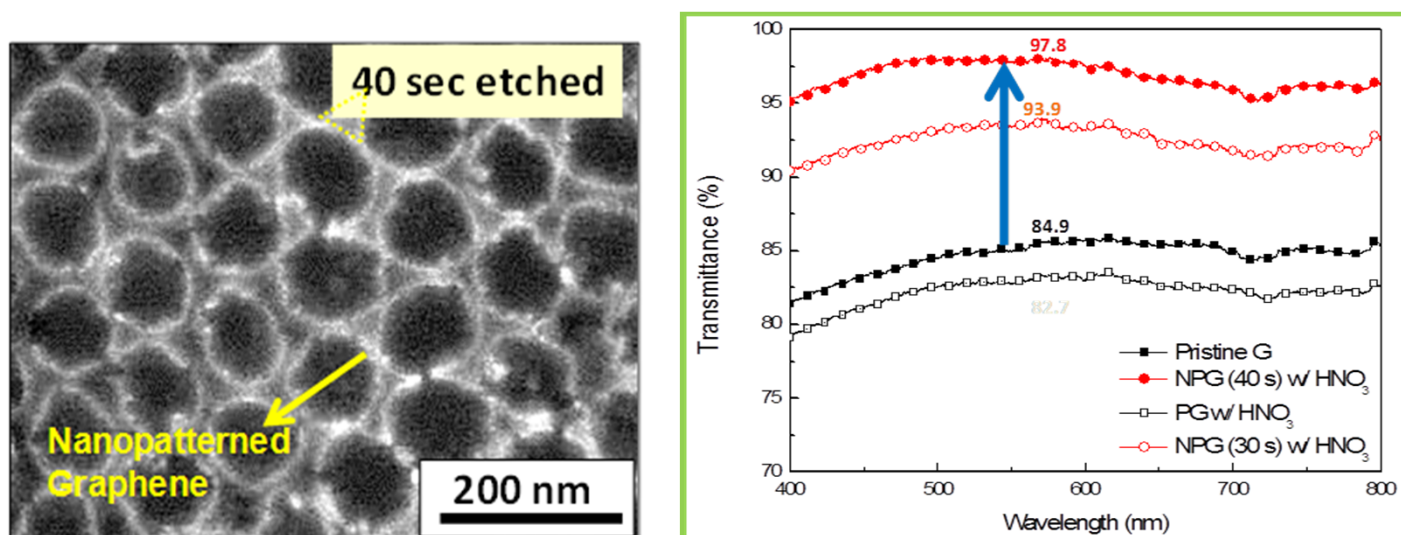


Fig. 1. (Left) SEM images of nanopatterned graphene network having $\sim 70\%$ opening and edge chemical doped structure for combination of high optical transmission and enhanced electrical conductivity. (Right) Enhanced optical transparency by nanopatterning.

Studies of chemical substitutions into the La site in the $\text{LaO}_{0.5}\text{F}_{0.5}\text{BiS}_2$ superconductor

Recently, superconductivity was discovered in the layered compounds $\text{Bi}_4\text{O}_4\text{S}_3$ and $\text{LnO}_{1-x}\text{F}_x\text{BiS}_2$ ($\text{Ln} = \text{La}, \text{Ce}, \text{Pr}, \text{Nd}, \text{Yb}$). BiS_2 based superconductors have attracted much interest in the condensed matter physics community, due to their exotic superconducting properties and the layered crystal structure.

It has been reported that the $\text{LnO}_{0.5}\text{F}_{0.5}\text{BiS}_2$ ($\text{Ln} = \text{La}, \text{Ce}, \text{Pr}, \text{Nd}$) compounds show marked T_c enhancements when subjected to applied pressure. A study of $\text{LaO}_{0.5}\text{F}_{0.5}\text{BiS}_2$ with various lattice parameters has shown that reducing the lattice parameters should have an effect on T_c . To further investigate the relationships between pressure, lattice parameters, and superconductivity, we have substituted Y ions into the La site in $\text{LaO}_{0.5}\text{F}_{0.5}\text{BiS}_2$. We observe that the critical temperature T_c appears to be correlated with the lattice parameter c and the La-O-La bond angle. Also, the chemical pressure resulting from Y substitution is insufficient to induce the high- T_c phase or the structural phase transition from tetragonal to monoclinic crystal structures seen under an applied pressure.

We also studied the evolution of superconductivity as well as the normal-state properties of polycrystalline samples of $\text{La}_{1-x}\text{Sm}_x\text{O}_{0.5}\text{F}_{0.5}\text{BiS}_2$ from $x = 0.1$ to the Sm solubility limit near $x = 0.8$. In addition to a considerable enhancement of the superconducting volume fraction, it is found that the superconducting transition temperature T_c is dramatically enhanced with increasing Sm concentration to 5.4 K at $x = 0.8$. Performing a linear extrapolation of T_c vs. x to $x = 1$ allowed us to estimate $T_c \sim 6.2$ K for $\text{SmO}_{0.5}\text{F}_{0.5}\text{BiS}_2$. The results are consistent with the trend of T_c vs. Ln for the reported $\text{LnO}_{0.5}\text{F}_{0.5}\text{BiS}_2$ compounds.

See related articles; 1) I. Jeon, D. Yazici, B. D. White, and M. B. Maple, "Effect of yttrium substitution on the superconducting properties of $\text{La}_{1-x}\text{Y}_x\text{O}_{0.5}\text{F}_{0.5}\text{BiS}_2$," *Physical Review B* **90** 054510 (2014). 2) Y. Fang, D. Yazici, B. D. White, and M. B. Maple, "Enhancement of superconductivity in $\text{La}_{1-x}\text{Sm}_x\text{O}_{0.5}\text{F}_{0.5}\text{BiS}_2$," Submitted to *Physical Review B* (2014)

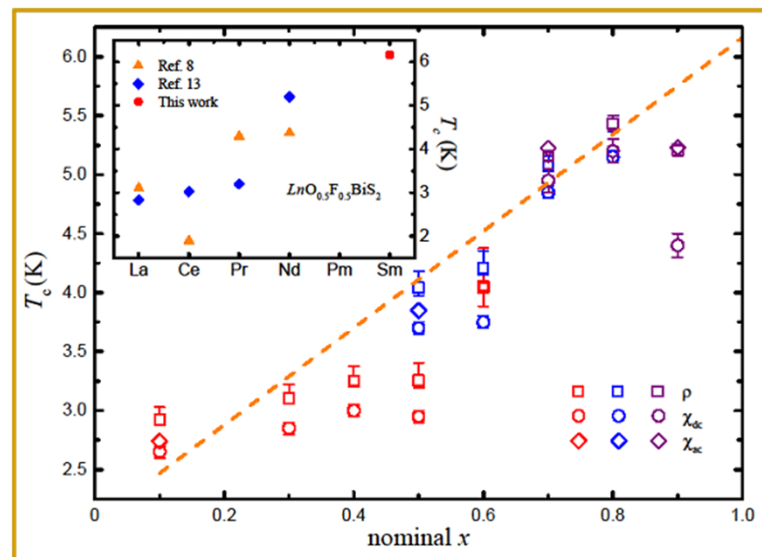
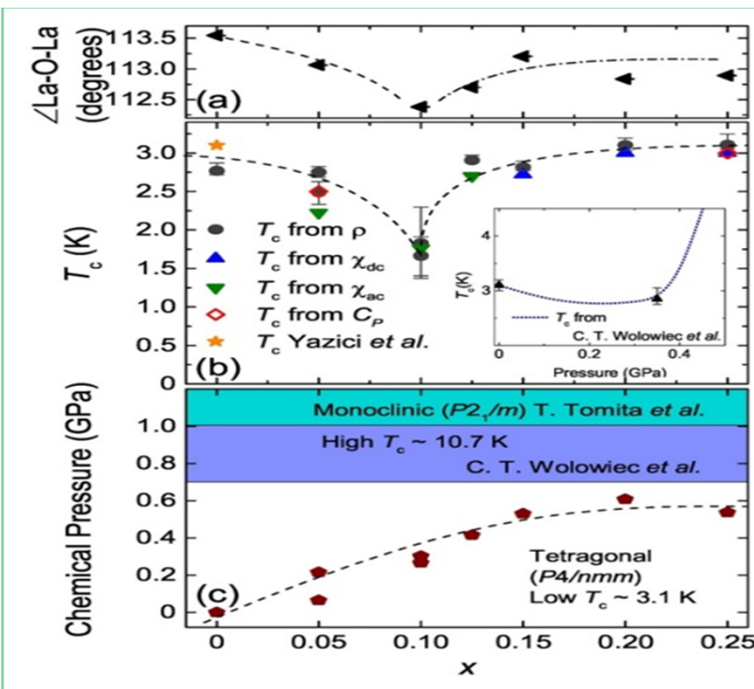


FIG. 1 (a) La/Y-O/F-La/Y bond angle $\angle \text{La-O-La}$ versus nominal yttrium concentration x . (b) Superconducting transition temperature T_c versus nominal yttrium concentration x for the $\text{La}_{1-x}\text{Y}_x\text{O}_{0.5}\text{F}_{0.5}\text{BiS}_2$ system. The inset shows the behavior of T_c under applied pressure. (c) Chemical pressure versus nominal yttrium concentration x . The chemical pressure does not increase further to either high- T_c and/or monoclinic phase.

FIG. 2 T_c vs. nominal Sm concentration x of $\text{La}_{1-x}\text{Sm}_x\text{O}_{0.5}\text{F}_{0.5}\text{BiS}_2$. Red, blue, and purple symbols represent results for samples annealed at 800°C, 750°C, and 710°C, respectively. (Inset) T_c of $\text{LnO}_{0.5}\text{F}_{0.5}\text{BiS}_2$ compounds together with the estimated T_c of $\text{SmO}_{0.5}\text{F}_{0.5}\text{BiS}_2$.

Alumni Interview



Jaeyun Moon
(U. of Nevada, Las Vegas)

1. How is your new faculty job? Are you setting up labs and hiring new students? How do you feel now that you are a professor instead of a graduate student?

I have been very excited to join UNLV and setting up my lab. One master student is working with me and I am looking for a motivated PhD student. As a professor, I feel more responsibility for my works and students, but it makes me enthusiastic as well.

2. How would you describe your MatSci training at UCSD?

I learned lots of things, such as knowledge, experimental skills and communication skills, from MatSci training at UCSD. I am really thankful that I had an opportunity to study at UCSD.

3. What aspects of MatSci education at UCSD do you think might have contributed to your successful acquiring of faculty position?

First of all, my advisors (Prof. Renkun Chen and Prof. Sungho Jin) had supported and educated me during my PhD study. It was a great experience to learn from them. The opportunity to work on a big project with my excellent colleagues at UCSD was also very helpful.

4. What are your suggestions/advices to the current MatSci students in order for them to obtain faculty job when they graduate?

If you always do your best, whatever you are doing, you will grab a great chance sometime. If you would like to be a faculty, please make an effort to have a broad perspective.

5. Any other things you would like to say/emphasize to MatSci students?

Just believe "the law of conservation of effort /fruit". Even though you cannot see any results right now, you will get rewarded for your efforts soon.



Michael Porter
(Clemson University)

1. The new job is great. It requires much more responsibility than being a graduate student, but I enjoy it tremendously. Although most of my time in this first semester is spent preparing lecture notes for class, I have begun interviewing and hiring graduate students and I am beginning to set up my lab. Forming a new research team is very exciting.

2. The MatSci program allowed me to become an independent researcher and form many long-term collaborations throughout UCSD, SIO, and the world. I took advantage of the connections provided to me by my advisors (for which I am very thankful) and the ample resources available on campus, including shared laboratory facilities (CallT2, Nano3), the Gordon Leadership Center, the von Liebig Entrepreneurship Center, and the Career Center.

3. The multidisciplinary nature and flexibility of the program allowed me to define my own degree objectives, allowing me to focus on the topics I thought would most benefit my research and future career goals.

4. Keep a current and up-to-date CV with all of your experiences, no matter how small. & Develop a memorable brand for yourself and your research - really think about who you are, and what you are good at. Then, create a website to illustrate this.

5. Take advantage of all the resources available on campus. The unique connections you make at UCSD can take you a long way into the future.

Student Awards & Honors

- **Marko Lubarda** was appointed as an Assistant Professor at University of Donja Gorica in Montenegro (2013). He received PhD under Prof. Vitaliy Lomakin and Prof. Eric Fullerton at UCSD.
- **Jaeyun Moon** was appointed as an Assistant Professor at University of Nevada, Las Vegas (in 2014). She received PhD under Prof. Renkun Chen and Prof. Sungho Jin at UCSD.
- **Michael Porter** was appointed as an Assistant Professor at Clemson University (in 2014). He received PhD under Prof. Joanna McKittrick
- **Jimmy Kan** graduated last year and is currently working at Qualcomm Inc. He was awarded the CMRR Schultz prize in 2013.
- **Tyler Kent** won the Best in Session Award in the Techcon 2014 Conference on the topic of CMOS Devices and Processes, with a paper title of “The Effects of InGaAs(110) and (001) Surface Cleans on the Nucleation of Low Temperature HfO₂ ALD”
- **Tobin Kaufman Osborn** got a job at Applied Materials, Inc. in Silicon Valley.
- **Kevin Huang** (PhD from Prof. Brian Maple's group in 2014) accepted a Postdoctoral Position in the Physics Department at Fudan University in China.
- **Ivy Lum** (Prof. Brian Maple's group) has started working at Quantum Design, Inc. in San Diego this year.
- **Sooyoung Jang** (Prof. Brian Maple's group) During the summer of 2014, she worked at Brookhaven National Laboratory (BNL) as a graduate student intern in the Condensed Matter Physics and Materials Science Department.

MSE New Faculty



From Left to Right

- **Drew Hall** (Department of Electrical and Computer Engineering) *CMOS integrated circuits for bioelectronics, biosensors, lab-on-a-chip devices, and other biomedical devices and systems.*
- **Kamil Godula** (Department of Chemistry and Biochemistry) *Nanotechnologies for analysis of glycan function during development. Glycomaterials for stem cell-based tissue regeneration.*
- **Wei Xiong** (Department of Chemistry and Biochemistry) *Investigation of charge transfer mechanism in nanomaterials with novel ultrafast spectroscopies.*
- **Yi Chen** (Department of Nanoengineering) *Engineering DNA nanostructure-based artificial biological systems for biomedical applications.*

New MSE Graduate Students in 2014

Welcome 43 New Graduate Students who joined our Materials Science & Engineering Program this academic year.

About the MSE Department Graduate Coordinator

Charlotte Lauve was raised in Texas and California in US. She grew up in San Diego, and has done extensive traveling, camping, fishing, surfing and horse back riding. Charlotte has worked at UCSD for almost 23 years as the Graduate Coordinator for the MSE Graduate Program.

Graduate student editor: This newsletter was edited by Paul Duyoung Choi, a senior graduate student in the Materials Science & Engineering Program.

Contact: Charlotte Lauve, Graduate Program Representative
UC San Diego Materials Science & Engineering Program
Tel: (858) 534-7715 • FAX: (858) 822-1129 • e-mail: clauve@ucsd.edu
<http://matsci.ucsd.edu>



Materials Science and Engineering Program
University of California, San Diego
9500 Gilman Drive, Dept. 0418
La Jolla, California 92093-0418

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