Society for the Advancement of Material and Process Engineering

SAMPE
Los Angeles Chapter
News and Information

November 2021

Surface Properties of Laser-Treated Molybdenum Disulfide Nanosheets for Optoelectronic Applications
Presented by Abdullah Alrasheed
From UCLA
November 10, 2021 (Wednesday) at 6:00 PM

Date:

11-10-21 (Wed)

Time:

6:00 PM

Reservations:

Register for the Zoom presentation.

Registration link at:

You are invited to a Zoom meeting.
When: Nov 10, 2021 06:00 PM Pacific Time (US and Canada)
Register in advance for this meeting at:
https://forms.gle/TfAWprJZWV6giku76

Then, to see the presentation, go to:
https://ucla.zoom.us/j/92458440595?pwd=elZWTVdWNWsyVWRYbnpNdEduTFF3QT09

SAMPE-UCLA Student Chapter

SAMPE-UCLA Student Chapter
SAMPE at UCLA started as an offshoot of the Materials Research Society at UCLA in 2015, and the SAMPE Student Bridge Project is now the primary technical project for undergraduate Materials Science and Engineering and Chemistry/Materials Science students at UCLA. Unfortunately due to the cancellation of the SAMPE 2021 Conference, beams were not manufactured. However, last year UCLA SAMPE introduced an open design project using online Hyperworks Tutorials to teach CAD and FEA. This fall, SAMPE's Technical Director Sydney Chang and SAMPE student project leads are preparing students to join SAMPE teams late Fall Quarter by teaching composite science to freshmen in the MSE 10 Seminar class alongside Professor Amartya Banerjee.

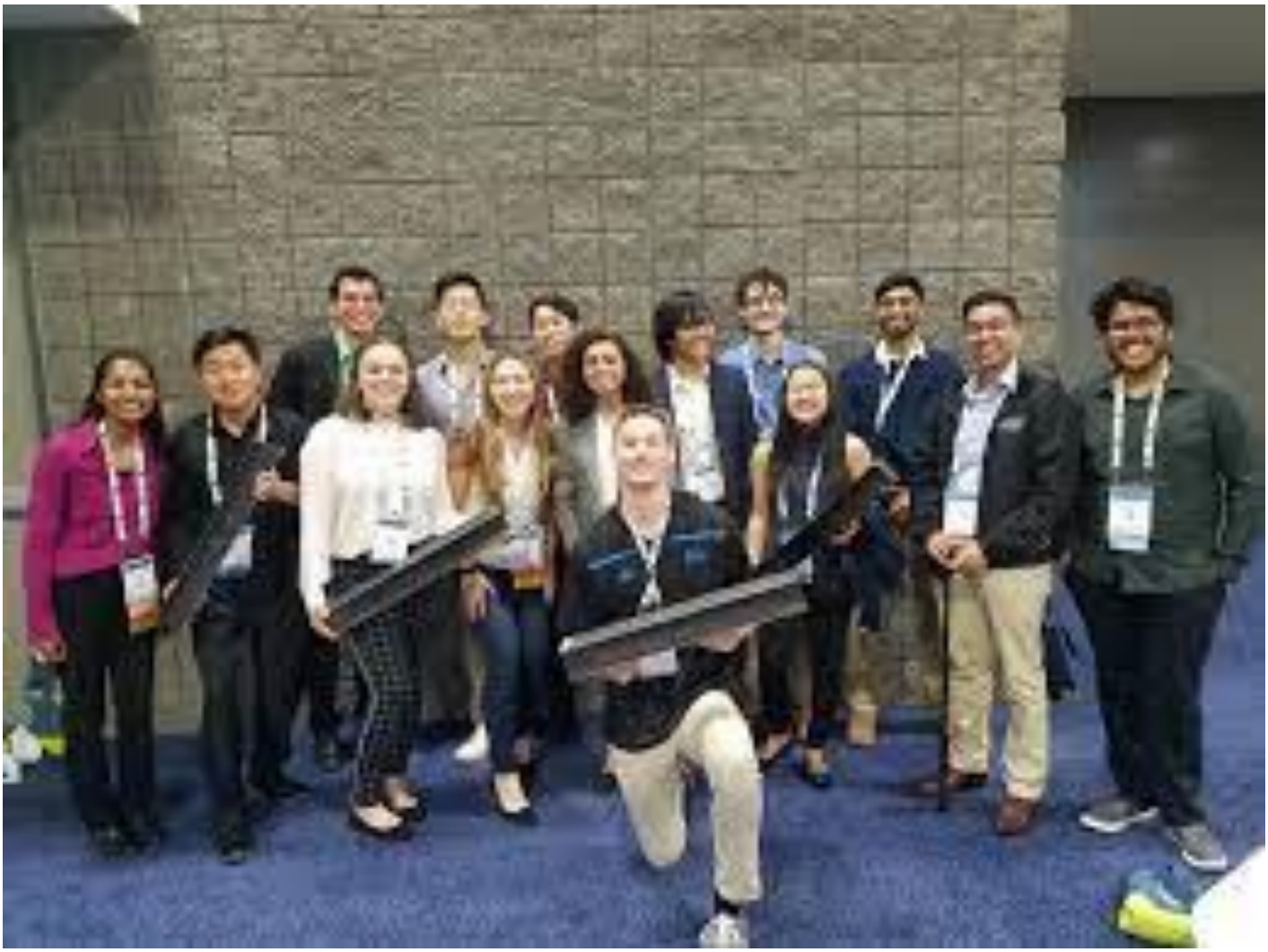
In 2019, the last Student Bridge competition, all of the UCLA teams reached design load. One team's carbon fiber square beam won 3rd place, the first time that a UCLA beam ever placed in the international competition! UCLA SAMPE has started this school year by including composite layup demonstrations and beam testing for the MSE 10 Freshmen Seminar and will start the competition design process by the end of Fall! With the help of UCLA Faculty, Materials Research Society at UCLA, LA SAMPE, and our sponsors, we've been able to accomplish so much and hope to regain momentum upon our return to campus! Thank you for your continued support as we look forward to another amazing school year!

About Abdullah Alrasheed

Abdullah Alrasheed is a material science and engineering PhD student at UCLA. His research focuses on the design and fabrication of nanomaterial for topological photonics and optoelectronic devices for quantum communication applications. Before coming to UCLA, he worked as a Research specialist for four years at the Center Excellence for Green Nanotechnology (CEGN) at UCLA and KACST. There he worked on the design and fabrication of 2D nanomaterial for optoelectronic devices, the design and fabrication of the semiconductor nanomaterial. Most specifically, Abdullah's research was to study and investigating the electrical and optical properties of 2D atomically thin materials such as molybdenum disulfide (MoS2) and other TMDCs, necessity of correlating quantum heat effects (phonons) , experimentally using confocal micro-Raman spectroscopy with the electric conductivity under different atmospheric environments . This was accomplished using vacuum chambers.

Abdullah's research on OPTICAL AND ELECTRICAL PROPERTIES OF 2D MATERIALS FOR DEVICE APPLICATIONS mainly included: Study the optical properties (Raman and photoemission) using micro-Raman spectroscopy on different 2D materials under different environments. This includes analysis of Raman and photoluminescence spectra using various techniques, studying and modeling the Degradation and Etching Dynamics of Exfoliated Black Phosphorus using optical methods, Laser-Treated Molybdenum Disulfide Nanosheets for Optoelectronic Applications and Investigating the phonon change due to anomalous particle formation on laser thinned MoS2, Investigating p-type and n-type transitions of deposited HfSe2 by performing laser treatment on gate devices for oxide doping. And correlating shifting Raman peaks with the material thickness, crystal structure and size.

SAMPE-UCLA Student Chapter Team Picture



UCLA participated in the SAMPE student beam competition, designing, building, and testing composite beams made out of carbon, glass, and natural fibers.

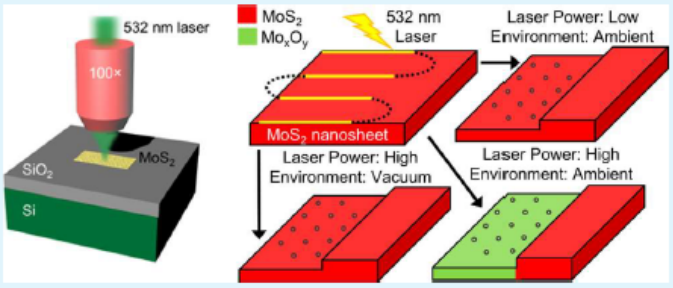
Striving to design and build the lightest beams (under two pounds) to hold a certain amount of weight (2500-9000 pounds) this competition requires optimizing our design and applying concepts we learn in class.

At the competition in Long Beach, CA, the glass fiber I-beam teams hit design load of 7000lbs and placed 4th and 5th out of 14 teams!

The next year, seven teams competed in May in North Carolina in carbon fiber, glass fiber, and natural fiber categories. All seven teams hit design load, with the UCLA Carbon Fiber Square Beam team placing 3rd!

Surface Properties of Laser-Treated Molybdenum Disulfide Nanosheets for Optoelectronic Applications

ABSTRACT: Transition metal dichalcogenide two-dimensional materials have attracted significant attention due to their unique optical, mechanical, and electronic properties. For example, molybdenum disulfide (MoS_2) exhibits a tunable band gap that strongly depends on the numbers of layers, which makes it an attractive material for optoelectronic applications. In addition, recent reports have shown that laser thinning can be used to engineer an MoS_2 monolayer with specific shapes and dimensions. Here, we study laser-thinned MoS_2 in both ambient and vacuum conditions via confocal μ-Raman spectroscopy, imaging X-ray photoelectron spectroscopy (i-XPS), and atomic force microscopy (AFM). For low laser powers in ambient environments, there is insufficient energy to oxidize MoS_2, which leads to etching and redeposition of amorphous MoS_2 on the nanosheet as confirmed by AFM. At high powers in ambient, the laser energy and oxygen environment enable both MoS_2 nanoparticle formation and nanosheet oxidation as revealed in AFM and i-XPS. At comparable laser power densities in vacuum, MoS_2 oxidation is suppressed and the particle density is reduced as compared to ambient. The extent of nanoparticle formation and nanosheet oxidation in each of these regimes is found to be dependent on the number of layers and laser treatment time. Our results can shed some light on the underlying mechanism of which atomically thin MoS_2 nanosheets exhibit under high incident laser power for future optoelectronic applications.



KEYWORDS: *molybdenum disulfide, X-ray photoelectron spectroscopy, confocal Raman spectroscopy, atomic force microscopy, nanoparticles, laser irradiation*

INTRODUCTION

Two-dimensional materials such as graphene and transition metal dichalcogenides (TMDCs) have been extensively studied in the past few years due to their exceptional mechanical, electrical, and optical properties.[1−3] In some applications, TMDCs are preferred over graphene, given that graphene lacks a band gap. Moreover, TMDCs such as molybdenum disulfide (MoS_2) exhibit a tunable band gap, which depends on the number of layers.[4] Due to weak van der Waals forces between the layers, it is possible to mechanically exfoliate layered TMDCs from their bulk form.[4,5] The resulting atomically thin MoS_2 nanosheets have demonstrated extraordinary electronic, photonic, and thermoelectric properties, which makes layered MoS_2 a strong candidate for various electronic and optoelectronic applications.[6−9]

As a result, several groups have been developing different methods by which to engineer and control the number of layers of MoS_2.[10−14] Most notably, Liu et al. demonstrated layer-by-layer thinning using argon plasma.[15] Their data show a reliable thinning of layered MoS_2 down to a monolayer. Gomez et al. showed laser thinning of the MoS_2 layers that had been mechanically exfoliated from a macroscopic MoS_2 crystal. The authors confirmed the formation of monolayers with a desired shape, an attractive method to engineer MoS_2 nanosheets.[16] However, their Raman results suggest that no oxidized MoS_2 peaks were observed, which led them to conclude that no oxide layers were formed after laser thinning.

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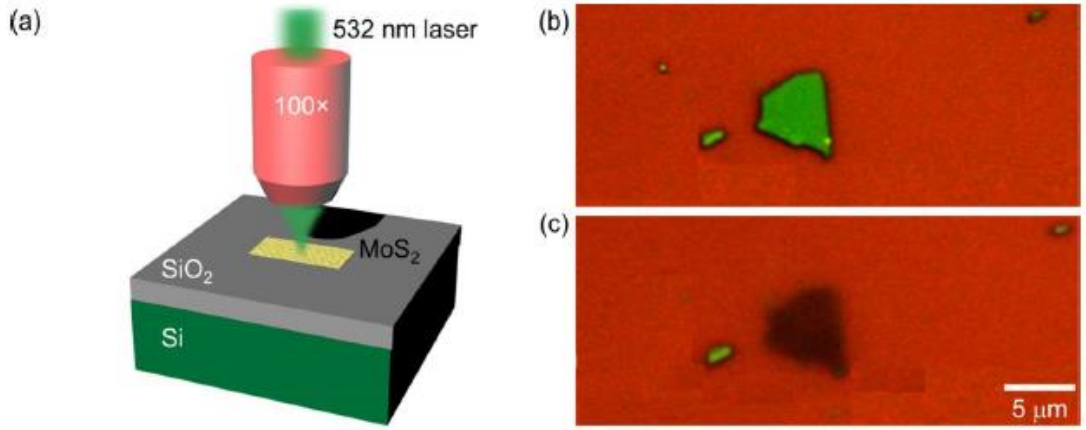

Schedule of Upcoming Events

Event	Presented From	Date
Optoelectronic Applications	UCLA	November 10, 2021
Measurment Science Symposium	Anaheim, CA	November 15 – 18, 2021
Westec and AeroDef	Long Beach, CA	November 16 – 18, 2021
Materials Innovaton & Advanced Technical Leadership Form	Huntington Beach, CA	January 26 – 27, 2022
Del Mar Electronics & Manufacturing Show	Del Mar, CA	May 4- 5, 2022
CAMX	Anaheim, CA	October 10 -13, 2022

A Happy and Sucessful UCLA Team

Irene Epstein Scholarship

The Irene Epstein Memorial Scholarship Awards were initiated in 1996 shortly after the death of Irene Epstein, to honor her volunteer efforts on behalf of the Society for the Advancement of Material and Process Engineering (SAMPE), and to recognize her strong desire to assist financially-needy, academically-deserving students at Fairfax High School (Los Angeles) to attend college to study engineering, science, mathematics, or medicine.

The Irene Epstein Memorial Scholarship Awards program was initially funded by contributions from The Aerospace Corporation and SAMPE. It is also supported by the Air Force Space Systems Manufacturing Problem Prevention Program (MP3).

The program is administered by Dr. Howard A. Katzman, Senior Scientist at The Aerospace Corporation, and Education Chairman of the Los Angeles Chapter of SAMPE.

Many individuals and companies have generously contributed to help the fund grow so the amount of the scholarship awards has increased five-fold since it started. In addition, a special Book Awards was introduced three years ago to help selected students in the purchase of their college textbooks. If you would like to make a donation or learn more about the scholarship, please contact Dr. Howard A. Katzman at 310-336-5860 or e-mail him at Howard.A.Katzman@aero.org.

Thank you all for your sponsorship and support of SAMPE – LA!!!

Our list of sponsors is growing!!! Sponsors get monthly exposure in our mailing to over 500 members and associates of the local chapters of SAMPE. Sponsors also get a link to their corporate webpage via the SAMPE Los Angeles Chapter website.

For information on being a sponsor, please contact:
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Thank you all for your sponsorship and support of SAMPE-LA!!!

ALL NEW!

Materials Innovation & Advanced Technology Leadership Forum

Towards Industrialization of Composites Manufacturing

SPONSORSHIPS AVAILABLE! Contact materialsforum@sampe.org

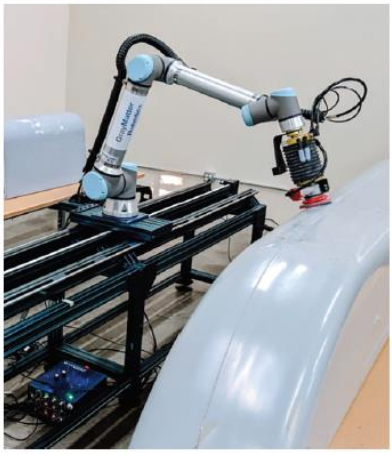
PLAN NOW TO ATTEND

WEDNESDAY, JANUARY 26, 2022

TIME	SESSION		
9:00am - 12:00pm	GrayMatter Robotics Tour - Limited to 50 registrants		
1:00 - 2:30pm	Track 1	Short Course	**Advances and Challenges in Automated Fiber Placement (AFP),** by Ramy Harik, University of South Carolina and Sayata Ghose, The Boeing Company
2:30 - 4:00pm			**Pultrusion Technology, Commercialization and Industrialization**, by Clement Hiel, Composites Support & Solutions, Inc.
1:00 - 2:30pm	Track 2	Short Course	**Non-Destructive Evaluation (NDE) Integration Into Modern Aerospace Manufacturing**, by David Forsyth, TRI Austin
2:30 - 4:00pm			**Thermoplastic Composites: Opportunities and Challenges**, by David Leach, ATC Manufacturing
1:00 - 2:30pm	Track 3	Market Overview	**Overview of Additive Manufacturing (AM) Market: State of the Art, Current Challenges and Opportunities, and Path Forward,** by Ahmed Arabi Hassen, Peeyush Nandwana and Vidya Kishore, Oak Ridge National Laboratory
2:30 - 4:00pm			**Market Overview of eVTOL and Urban/Advanced Air Mobility (UAM/AAM),** by Johnny T. Doo, Devonshire Holdings, Inc.
4:00 - 6:00pm	Welcome Reception		

ROBOTICS TOUR

See for yourself how GrayMatter Robotics makes AI-Brains for robots by taking commercially available robots and connecting them to artificial intelligence software, creating smart robotic assistants for high-mix surface treatment applications. **Tour attendance is limited to 50 registrants, register today.** Visit **materialsinnovationforum.org/tour.**



VENUE & LOCATION — HUNTINGTON BEACH, CA

The forum will be held at the **Kimpton Shorebreak Resort**, 500 Pacific Coast Highway, Huntington Beach, CA 92648. Book your room at **materialsinnovationforum.org/hotel-registration.** Huntington Beach is located in Southern California, within driving distance to numerous manufacturing companies and offers a plethora of activities for visitors — live entertainment, iconic bonfire pits, beautiful sandy beaches, and oceanfront dining year-round.

SEATS ARE LIMITED. REGISTER AT: materialsinnovationforum.org

Below is the link to the Jan 2022 Forum registration page:

https://365.sampe.org/networks/events/9917

FORUM SPEAKERS & PRESENTATIONS

THURSDAY, JANUARY 27, 2022

SESSION 1 — CHALLENGES

8:10am - 9:40am

- Air Mobility - Economy of Scale, *John Geriguis and Nobuya Kawamura*
- Recycling and Circular Economy of Automotive Composite Parts, *Hendrik Mainka*
- Composite Material Opportunities and Challenges for Air Mobility and Unmanned Systems, *Robert Yancey*

John Geriguis, Joby Aviation

Nobuya Kawamura, Toyota Motor North America, Inc.

Hendrik Mainka, Volkswagen Group of America, Inc.

Robert Yancey, Hexcel

SESSION 2 — SYNERGIES

10:00am - 12:00pm

- Synergy of Aerospace and Wind Energy Composites Technologies, *Wendy Lin*
- Pultrusion with Design Freedom
- Advances in Manufacturing Carbon-Carbon Composites for High Temperature Applications, *Matthew Parkinson*
- Part Throughput is one of the Most Limiting Factors When Working in the Composite Industry, *Adam Rawlett*
- Alternate Methods For Increasing Composite Part Throughput, *Sam Tollefsen*

Wendy Lin, GE Renewable Energy

Matthew Parkinson, BASF Performance Materials

Adam Rawlett, US Army Research Laboratory

Sam Tollefsen, Toray Composite Materials America, Inc.

SESSION 3 — ADVANCEMENTS

1:30 pm - 3:00pm

- Rapid Large-Scale Structural Thermoplastic Parts, *Michael Assadi*
- NCC's Digital for Composites (D4C) – From Right First Time to Right Every Time, *Enrique Garcia*
- Aerospace Integral Structures by LRI Based in Automated Lamination of Fabrics with ADMP, *Peio Olaskoaga*

Michael Assadi, Electroimpact Inc.

Enrique Garcia, National Composites Centre

Peio Olaskoaga, IDEKO Research Center

SESSION 4 — SIMULATION/SOFTWARE CONTRIBUTORS

3:30 pm - 5:20pm

- AI-Based Production Scheduling And Process Optimization Drive Manufacturing Agility And Efficiencies, *Avner Ben-Bassat*
- How Credible Simulation Significantly Reduces Product Development Time and Cost, *Javad Fatemi*
- Software Platform Solutions for Composites Design, Manufacturing and Simulation 4.0, *William Ramroth*
- Efficient Manufacturing for 21st Century Composite Structures, *Alex Rubin*

Avner Ben-Bassat, Plataine

Javad Fatemi, Airbus Defence and Space

William Ramroth, Dassault Systemes

Alex Rubin, The Boeing Company

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