The island of Oʻahu served as the perfect location for the first in-person MRS Spring Meeting since the beginning of the COVID-19 pandemic. The 2022 MRS Spring Meeting & Exhibit was graced with a traditional Hawaiian blessing at the opening ceremony and closed out with a luau. Among reasons to celebrate is that the Meeting Chairs—Manish Chhowalla (University of Cambridge), Eunjoo Jang (Samsung Electronics), Prineha Narang (Harvard University), Tsuyoshi Sekitani (Osaka University), and Vanessa Wood (ETH Zürich)—coordinated with sister societies in Japan, South Korea, and Singapore to present joint symposia and sessions. The purpose was to share and discuss research across the Pacific Rim, provide networking opportunities, and grow a higher level of support and awareness for materials research and innovation. With over 5300 attendees—rendering this among the largest MRS Spring Meetings—the partnership was a success!

The Meeting was held in-person in Honolulu on May 8–13, then continued with the Virtual Experience on May 23–25. Tutorials complemented the 71 symposia, grouped into nine topical clusters, with joint symposia and sessions organized with The Japan Society of Applied Physics, The Korean Institute of Metals and Materials, MRS-Korea, MRS-Singapore, and The Polymer Society of Korea. This year’s panel Hawai’i offers a great location for a joint Meeting with sister societies in Japan, South Korea, and Singapore.

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SOCIETY NEWS

2022 MRS Spring Meeting & Exhibit celebrates materials research

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By Judy Meiksin, Henry Quansah Afful, Xinzi He, Corissa Heyes, Matthew Nakamura, Mohit Saraf, and Shubham Tanwar

The 2022 Materials Research Society (MRS) Spring Meeting & Exhibit was graced with a traditional Hawaiian blessing at the opening ceremony.
discussions included “Materials Needs for Energy Sustainability by 2050: Is Hydrogen the Fuel of the Future?” and “40 Years of Semiconductor Research Corporation and 2030 Decadal Plan for Semiconductors,” plus the Meeting offered numerous professional development opportunities.

Scientific highlights

In Symposium CH03—Advances in In Situ and Operando TEM Methods for the Study of Dynamic Processes in Materials—a joint symposium with MRS-Singapore—Judy Cha, the Carol and Douglas Melamed Associate Professor in the Department of Mechanical Engineering and Materials Science at Yale University, gave a presentation on “In Situ TEM Studies of Microstructure Control During Nanoscale Phase Transformation.” Phase transformation in nanoscale materials often differs from what is observed in their bulk counterparts owing to differing kinetics and thermodynamics of the transition at these scales. In situ transmission electron microscopy (TEM) techniques make it possible to track the nucleation and growth kinetics in these materials. Knowledge of the kinetics helps to control the phase transformation and resultant microstructure. TEM studies revealed that the crystallization temperature of <50-nm-diameter wires of metallic glasses is much higher than in the bulk and attributed this to the absence of preexisting nuclei. Cha showed that the critical cooling and heating rates for transformation in these materials overlap at these small scales compared to being distinguishable in the bulk. Cha also demonstrated, using TEM, that the growth is 20 times slower when cooling from 900°C to 420°C than when heating from 20°C to 420°C. In situ TEM can also be used to study the nanoscale nucleation and growth pathways in condensed-matter systems. Understanding and controlling the nucleation density opens up several applications for these materials.

Plants are as living as humans and need to be healthy for their proper functioning. By developing sensors that can monitor their health, steps can be taken that can improve the yield and quality of bio-products. Sugar is one of the most critical components that dictate health and growth. The desired sensor needs to be minimally invasive and should be able to provide real-time monitoring; simultaneously, being cheap can improve the adaptability and widespread use of the technology. In Symposium EQ03 on Next-Generation Organic Semiconductors—Materials, Fundamentals and Applications, Eleni Stavrinidou, an associate professor from Linköping University, presented transistor-based health monitor devices that can be interfaced with plants. They can also control their physiology. For example, when plants are stressed in drought-hit areas, the developed bioelectronics devices can release biomolecules that help close their pores to prevent water loss and relieve stress. With the increased risk of climate change and growing population, these sophisticated tools can help plants increase their productivity.

Also in Symposium EQ03—organized jointly with The Japan Society of Applied Physics—University of Southern California professor Barry Thompson presented a two-pronged proposal for decreasing environmental impact of generating conjugated polymers by increasing the sustainability of direct arylation polymerization (DArP). The conventional process involves the use of toxic solvents (e.g., toluene, xylenes, mesitylene, and PhCl). Thompson proposed to use aromatic solvents like p-cymene that have a much higher boiling point, are not peroxide forming,
and are very effective for conjugated polymer processes. The conventional process involves (rare/expensive) palladium as a catalyst. First, his research group thought to replace the palladium catalyst with copper; however, the use of a copper catalyst is not well-enough understood. His further suggestions included a shift to a heterogeneous process in order to be able to reuse the palladium catalyst. Experimental data support a 90%+ recyclability of the palladium when used with traditional solvents, which does not work with p-cymene due to its non-polarity. In future work, Thompson’s group will address combining these proposed alternative options.

Photopolymer additive manufacturing (PAM) offers an exciting route for three-dimensional (3D) printing different products in numerous industries owing to its versatility in the materials-applications space. However, light sources being used in different PAM technologies lack the precision required to accurately study photopolymerization during printing. Recent research has demonstrated that during printing, variations in exposure of various surfaces to light can negatively impact polymerization and the resultant properties of the printed part. It is therefore crucial that the individual pixels of the light source are well characterized to ensure effective polymerization and enhanced materials properties. Callie Higgins, a materials research engineer at the US National Institute of Standards and Technology, developed a light-engine that incorporated atomic force microscopy (AFM) to understand in situ properties of the print because it has the desired lower temporal and length scales required for studying the polymerization process. The AFM afforded the study of modulus and damping capacity at the exact location of prints, and this also helped detect polymerization tens of micrometers away from the light source. “The setup we designed provides in situ information on the exact location of prints and as such renders itself useful to the modeling community,” Higgins said during her presentation in Symposium DS02 on Advanced Manufactured Materials—Innovative Experiments, Computational Modeling and Applications.
Some face-centered-cubic (fcc) high-entropy alloys (HEAs) possess high strength and ductility at low temperatures in addition to high fracture toughness. In Symposium SF09—High Entropy Materials II—From Fundamentals to Potential Applications, Haruyuki Inui of Kyoto University pointed out that single-crystal mechanical data are useful in tracking the correlations between various parameters and these mechanical properties. He introduced one such parameter—the mean square atomic displacement (MSAD)—as a useful predictor of the mechanical behavior in these HEAs. Inui demonstrated that the MSAD is independent of the number of elements in HEAs but rather depends on the elements constituting the alloy. Part of the reason is that the MSAD has a strong correlation with increasing atomic number. Also, MSAD values can be used to predict the strength of these HEAs because of a strong correlation between these, but there has to be further modification to ensure it predicts the right order of increase in strength. The critical resolved shear stress in these alloys tested had both temperature and strain-rate dependence similar to observations in typical fcc solid solutions. CrCoNi was the strongest of the alloys.

In Symposium EQ04 on Advanced Soft Materials and Processing Concepts for Flexible Printed Optoelectronic Devices and Sensors, Unyong Jeong of Pohang University of Science and Technology discussed advances in stretchable nanomaterials able to provide tactile functionality with pressure-sensing capabilities for applications in bio-interfaces and gentle-touch robotics. These “synthetic skins” can be utilized in place of conventional rigid devices, even under deformation conditions where more general materials would either fail or underperform. Additionally, the associated groundwork for integration into more complex systems was addressed with a primary focus on providing a deeper understanding of the hardware aspects of this emerging technology. Next steps include a study of manufacturing constraints and scalability.

Various materials properties have been successfully predicted using first-principles ab initio calculations. For more complex properties such as higher order responses, this approach is not tenable due to the immense computational time required. Machine learning (ML) offers a more viable route to address this need but a lot of data—which are not available for these complex properties—are required for more accurate predictions. Gian-Marco Rignanese of Université Catholique de Louvain addressed this problem by developing a new ML framework that relies on little data. This framework, Materials Optimal Descriptor Network (MODNet), is a feedforward neural network that predicts target materials properties such as vibrational entropy by identifying meaningful physical features that correlate well with the target property. By highlighting the most important features, the underlying physics can be better understood. In Symposium DS03—Phonon Properties of Complex Materials—Challenges in Data Generation, Data Availability and Machine Learning Approaches, Rignanese demonstrated that this framework performs better than other ML approaches, especially for much limited data sets. For instance, the vibrational entropy for some crystals at 305 K was predicted with an error four times lower than calculated in other models.

Carbon fiber composites have shown potential for use in energy storage applications such as electrodes in car batteries. “The main challenge facing carbon fibers in energy storage
is their very small surface area,” said Luke Henderson (Deakin University) in Symposium SF12 on Bioinspired Structural Composites—Advances in Experiments, Simulations and AI-Based Design. Some approaches attempted to increase the surface area sacrifice some mechanical properties of the carbon fiber. Henderson addressed this problem by grafting a conductive polymer (polyaniline) to the carbon fiber surface using a new, relatively easier method developed in his laboratory. A reductive potential is applied to the fibers in an electrochemical bath that reduces the polymer in the electrolyte, setting up a chain of reactions to graft the polymer to the fiber surface. Henderson used this method for different polymer chemistries and layers and demonstrated an increase in the tensile strength of the composite by up to 45 percent. This increase was due to the reinforcement of defects on the fiber surface from the grafting. Also, this method improved the polymer adhesion on the fiber surface by up to 215% higher than what is obtained conventionally.

Several engineering applications—aerospace, wearables, biomedical devices—exist for flexible, stretchable, and “human muscle-like” actuators. However, it is very difficult to obtain these characteristics in some materials. Sung-Hoon Ahn of Seoul National University addressed the role that the form, scale, and composition of materials play in producing such multifunctional actuators with interesting behaviors. During his talk in Symposium SF13—From Actuators and Energy Harvesting Storage Systems to Living Machines, Ahn showed that different materials compositions (binary, ternary, or multinary) could have different actuation strains and phase transformation/working temperature ranges. Also, the form of the material designed affects its modes of actuation—contraction, bending, twisting, and rotation—and a soft smart composite designed in Ahn’s laboratory demonstrates this. He further addressed the misconception that shape-memory alloys (SMAs) have slower actuation by demonstrating that fabricating very thin SMA wires increases the switching frequency to several hertz. Furthermore, at such scales, the strain recovery can be in response to a remote laser beam instead of direct heat application. These ideas of form, scale, and type of material can all be merged to inform SMA design and enlarge their application space.

In Symposium EQ11 on Neuro-morphic Computing and Biohybrid Systems—Materials and Devices for Brain-Inspired Computing, Adaptive Biointerfacing and Smart Sensing, Andres Arrieta of Purdue Sensing, Andres Arrieta of Purdue University demonstrated the groundwork for an “event camera” to facilitate the creation of more robust interphases between the physical world and systems like soft robotics. Such a camera would ideally integrate memory formation, retention, and recall over long periods of time. Additionally, this camera should measure tactile input to allow systems to “feel” their environment and recognize/
Energy storage devices

In Symposium EN05 on Emerging Materials for Electrochemical Energy Storage Devices—Degradation and Failure Characterization—From Composition, Structure and Interfaces to Deployed Systems, Linda Nazar OC FRS of the University of Waterloo talked about all-solid-state batteries (ASSBs), which offer many advantages over other systems but have many associated challenges. Whereas liquid electrolytes raise safety concerns and are limited by a narrow voltage (4.3 V), solid electrolytes (SEs) demonstrate improved safety, enhanced energy density (by a factor of 2–3), and can be operated over a wide operational range. Nazar pointed out that dual solid electrolytes are likely necessary for ASSBs and discussed her recent works where LiNi_{0.85}Co_{0.1}Mn_{0.05}O_{2} exhibit superior rate capability and long-term cycling (up to 4.8 V versus Li^{+}/Li) compared to state-of-the-art ASSBs. Nazar gave many other examples of her recent work where her group obtained promising results. These results pave the way for designing SEs with a low electronic/ionic conductivity ratio. She also stressed upon establishing a framework to study the halide SEs and electrochemical stability of SEs. Nazar concluded her talk by mentioning that new solid halide electrolytes enable “bare” high-voltage cathode materials for batteries.

Esther Takeuchi, Distinguished Professor at Stony Brook University, The State University of New York and a chief scientist at Brookhaven National Laboratory, investigated several electrode materials using *operando* isothermal microcalorimetry (IMC), which she discussed in Symposium EN05. First, for the conversion-type anode material, the heat dissipation of Fe_{3}O_{4} was able to be tracked during lithiation using IMC. Comparing the electron counts between theoretical modeling and calculation from IMC, a surface effect caused by particle aggregates can be found, which was further confirmed by *operando* x-ray absorption spectroscopy. Removing the aggregates resulted in higher capacity, which also makes results from multi-modal consistent. The reversibility of the Fe_{3}O_{4} was enhanced by establishing a fluoroethylene carbonate modified SE interphase. Second, parasitic reactions were detected during the lithiation and delithiation of silicon anode material. The onset and evolution of heat dissipation associated with parasitic reactions were observed by subtracting entropic and polarization terms from the total heat. The parasitic heat is largest in the first lithiation and does remain detectable during subsequent lithiation cycles. “A detailed analysis of battery heat generation is critical in battery and battery-related materials design, manufacturing, and characterization,” Takeuchi said.

The critical current density (CCD) for solid-state batteries pairing with a lithium anode is always discussed in the scenario of dendrite penetration. Peter Bruce FRS of the University of Oxford began his talk in Symposium EN06 on Solid-State Batteries—From Electro-Chemo Mechanics to Devices by pointing out that the void formation on the lithium stripping side can be another critical reason that makes the CCD smaller than the dendrite-penetration-controlled one. Moreover, using x-ray computed tomography, the location where dendritic cracks initiate and propagate was revealed. The cracks were found driven by Li at the back of the crack, not the tip. An important lesson found is that lower stacking pressure can be more favorable to achieving higher CCD without crack propagation. In the end, together with the Session chairs Matthew McDowell (Georgia Institute of Technology) and Xin Li (Harvard University), Bruce discussed how the cell structures design—with and without lateral restriction—may influence these crack phenomena.

Also in Symposium EN06, Liang-bing Hu, Herbert Rabin Distinguished Professor and Director of Center for Materials Innovation at the University of Maryland, discussed ultrafast high-temperature sintering (UHS) for solid-state electrolytes. The UHS enables the tuning of the sintering time in units of seconds, which provides excellent control in terms of the Li content and grain growth. By
programming the temperature and time, various solid-state electrolytes with different compositions and microstructures can be synthesized. Hu then discussed one-dimensional (1D), high-performance polymer solid-state ion conductors. By opening the molecular channels between the cellulose chains through Cu²⁺ coordination, the originally non-conducting cellulose nanofibrils were able to achieve a high Li⁺ conductivity. In the end, Hu, together with the Session chairs Li and Neil Dasgupta (University of Michigan) discussed the future challenges of manufacturing all-solid-state batteries and provided advice for young principal investigators in managing projects and students.

**Advances in MXenes**

This year, MRS offered a program on two-dimensional (2D) MXenes, first reported in 2011. Three authors of this publication (https://doi.org/10.1002/adma.201102306)—Michel Barsoum, Yury Gogotsi, and Michael Naguib—gave a presentation in Symposium NM03—2D MXenes—Synthesis, Properties and Applications. Barsoum, Distinguished Professor at Drexel University and known leader of MAX phases (where M is a transition metal, X is C or N, and A is mostly an element from group 13 and 14), spoke about quaternary ammonium compound-derived nanostructures. Traditionally, 2D materials are produced by etching of layered solids. In a recent report, researchers used a bottom-up approach to convert 10 binary and ternary titanium carbides, nitrides, borides, phosphides, and silicides into 2D materials by immersing them in a tetramethylammonium hydroxide solution under ambient conditions. Barsoum gave examples of 1D anatase TiO₂ and 2D birnessite-based Mn oxides. His research team characterized the produced materials by various techniques such as x-ray powder diffraction, Raman spectroscopy, x-ray photoelectron spectroscopy, electron energy-loss spectroscopy, and x-ray absorption near-edge spectroscopy, which concluded that the flakes contain carbon and are anatase-based layers of 1D sub-nanometer filament that grow in [200]. The group used these newly produced materials for electrochemical energy storage and biomedicale applications. In conclusion, they provided a novel approach of producing 2D materials from non-layered, cheap, scalable, and earth-abundant precursors at ambient conditions. The study opens new possibilities in the rapidly growing field of 2D materials for a diverse range of applications.

Gogotsi, Distinguished University and Charles T. and Ruth M. Bach Professor and director of the A.J. Drexel Nanomaterials Institute at Drexel University, highlighted the importance of synthesis of MXenes from environmentally friendly, safe, efficient, and scalable methods. Typically, MXenes are synthesized from MAX phases by etching with acids (HF and HCl) followed by delamination. Their properties can be controlled by tuning their compositions and structures. They are hydrophilic, easily dispersible in water, strong, stiff, and possess high electrical conductivity, making them suitable for a wide range of applications. However, the synthesis of MXenes may have some challenges such as use of HF acid, which is highly corrosive and dangerous for the human body and, therefore, the safety is equally important. This requires safety equipment, which makes the overall synthesis process expensive. Therefore, safer and environmentally stable synthesis is important. Gogotsi also emphasized the computational approaches of predicting the exfoliability of MAX phases. He said that different MXenes require different reaction parameters and therefore the exfoliation energy and etching parameters need to be adjusted, rendering that guidance from computational studies is important. He mentioned that stoichiometry of MXenes is also important and usually MXenes inherit the characteristics of MAX phases. The selective etching of MAX phases is significant, and he discussed etching and delamination mechanisms. Gogotsi said that as per his knowledge, MXenes are the only nanomaterials that can be produced in kilogram of scale, meaning true industrial scale applications can be addressed. Lastly, he mentioned several new MXene synthesis protocols coming up such as molten-salt synthesis, which are relatively safer.

Naguib, assistant professor at Tulane University and who was previously a student in Gogotsi’s group and first author of the 2011 article, discussed MXenes and their properties such as electrical conductivity and capability of hosting multivalent ions, which make them promising candidates for electrochemical energy storage. He talked about the structural and computational diversity and tunability of MXenes and highlighted the importance of intercalation in MXenes to escalate their properties to be used in a variety of applications. Naguib provided several examples of intercalation of cations into the MXene structure that were successfully used in supercapacitors, Na-ion capacitors, and other applications. His research group also tested MXenes in several new
At the Women in Materials Science & Engineering Breakfast, Seung Min Jane Han, from Korea Advanced Institute of Science and Technology, presented her work on ultrahighstrength metal-graphene nanolayered composites for flexible electrode applications, followed by a talk about her career path.

Miladin Radovic, a professor and director of the Materials Characterization Facility at Texas A&M University, discussed MXenes and all top-down strategies reported until the date of producing them. He also explained the danger and toxicity associated with these approaches and emphasized a safer etching protocol that can produce single or few layer MXenes in aqueous solutions at room temperature. Radovic’s research team proposed a water-soluble tetraethylammonium fluoride tetrahydrate agent that can work as etchant and intercalant at the same time. This technique removes an additional step of intercalation, and the yields were found to be similar to previously reported methods. The results were explained on T1C2 and T12C MXenes. The results open the possibility of using a range of quaternary ammonium salts in aqueous solutions for safer and scalable MXene synthesis.

Drexel University associate professor Ekaterina Pomerantseva used MXenes as precursors for synthesis of oxide materials. The versatile chemistry and 2D morphology of MXenes make them unique precursors for the synthesis of other classes of materials. She first talked about α-V2O5-derived δ-V2O5, H2O (BVO) material, where the synthesis takes longer, involves an aging step, and requires higher temperatures. In a recent study, her group replaced α-V2O5 with V2CT, MXene that was oxidized with the help of H2O2, and the synthesis can be completed without the aging step at lower temperatures. A flower-like morphology was observed for the prepared materials. The resultant V2CT-derived δ-V2O5-nH2O structure was intercalated with various ions such as Li and Mg and was used for electrochemical energy storage applications. Pomerantseva also discussed recent results of MXene-derived K-intercalated V2O5 (KVO) showing promising results for battery applications. She said that this synthesis route of using MXenes as precursors can be extended onto other MXenes to produce oxides with different chemistries or mixed oxides.

Vadym Mochalin, associate professor at Missouri University of Science and Technology, highlighted the importance of understanding the chemistry of MXenes, including their synthesis and stability. MXenes have been considered as unstable in aqueous colloids due to oxidation and therefore the challenge is improving their chemical and temperature stability. However, this oxidation process can be used to prepare composites. Mochalin gave an example of MXene-titania composites that can be produced by a simple, inexpensive, and environmentally benign process of delaminating and storing MXenes under ambient environment, which leads to the partial oxidation of MXene to prepare a composite. This composite demonstrates attractive properties for photoresistors with memory effect and sensitivity to the environment, as well as many other photo- and environment-sensing applications. He showed experiments explaining that it is the hydrolysis, not oxidation, which is primarily responsible for MXene instability. According to Mochalin, acidic environment catalyzes the hydrolysis of MXenes and basic environment inhibits MXene hydrolysis. Also, high pH suppresses MXene hydrolysis and antioxidants suppress MXene oxidation. The synergistic actions of high pH and antioxidants are most beneficial for the shelf life of aqueous MXene colloids at room temperature. Mochalin provided some examples illustrating connections between understanding MXene chemistry and potential applications.

In the area of materials and energy, Majid Beidaghi, associate professor and Ginn Faculty Achievement Fellow at Auburn University, said that despite having unique physicochemical properties, the application of MXenes in energy storage depends on their assembly into electrode structures. His research group is developing assembly of MXene flakes into such electrode structures that exhibit high power and energy. He also discussed the effects of MXene synthesis conditions and importance of controlling flake size on the electrochemical performance. He showed several videos of 3D printing of the MXene electrode where his research group successfully used MXene inks for printing on different substrates. Moreover, Beidaghi emphasized developing heterostructured MXenes for superior chemical and electrochemical stability and energy storage capability.

Postdoctoral researcher Mehrnaz Mojtabavi, now at the Center for Neuroengineering and Therapeutics at the University of Pennsylvania, works with MXenes in her studies on bioelectronics and neural interfaces based on nanomaterials. In Symposium NM06 on
Nanoscale Mass Transport Through 2D and 1D Nanomaterials, she highlighted the importance of nanopore technology that has gained wide attention in single-molecule studies of biomolecules. This technology provides an opportunity for sensing, manipulation, and sequencing of biopolymers such as DNA, RNA, and proteins. Mojtabavi discussed the significance of 2D materials such as graphene and MoS₂ in this emerging technology and introduced the promising candidacy of MXenes in this area. She said that despite the robustness of this emerging technology, the sensing resolution is usually limited by pore thickness and access resistance. These issues can be addressed using MXene-based technology as they are hydrophilic and possess excellent electrical conductivity. She used two MXenes, Ti₃C₂ and Ti₅C, in her work and achieved promising results. She also introduced four MXenes-based approaches for nanopore technologies, that is (i) single-molecule sensing with MXene nanofibers, (ii) water-scale MXene film fabrication and transfer, (iii) ionically active MXene nanopore actuators, and (iv) ion-fountain nanopore reader. She concluded that 2D materials, particularly MXenes, are promising candidates for nanopore-based single-molecule sensing, and development in this field will open new possibilities in the future.

In a special event held in the Exhibit Hall, Song K. Choi, assistant dean in the College of Engineering at the University of Hawai‘i at Mānoa (UHM), described the areas of materials research conducted at the university. Although there is no specific department on materials science and engineering, the studies are incorporated across four colleges.

In the College of Engineering, the largest range of the materials fields is conducted, including nanotechnology, smart materials, carbon nanotubes and graphene, additive manufacturing, modeling, and corrosion. Studies on energy generation and energy storage take place in the School of Ocean and Earth Science and Technology, as well as studies on biomass, crystal nucleation and growth, and catalysis. The College of Natural Sciences includes research in nanomaterials, graphene, and hydrogen storage materials. The College of Tropical Agriculture and Human Resources includes work on soils, minerals, and clays.

Taking advantage of the location of this year’s Meeting, graduate students at UHM reported research in talks as well as the poster sessions. Following are a few highlights. Anh Tuan Nguyen in Woohul Lee’s group reported on the development of a suspended micro-island device method of measuring thermal conductivity of PEO/PEDOT:PSS near-field electrospin polymer nanofibers. Light weight, low-cost, polymer nanofibers are generally considered to be insulators at bulk scale; however, applications for polymer nanofibers require higher thermal conductivity values. This work demonstrated that higher molecular weight PEO/PEDOT:PSS polymer nanofibers have four times improved thermal conductivity compared to their low weight counterparts (which generally match the bulk scale thermal conductivity value). Additionally, data explain the glass-transition effect on thermal conductivity measurements generated in the measurement process. Future work includes generating a cross-link between PEO and PEDOT:PSS to further increase thermal conductivity of the polymer nanofiber. This work was presented in Symposium SF15 on Thermal Processes and Management Under Unconventional Conditions.

Chung-Han Wu in Tyler R. Ray’s group presented a low-cost, 3D-printed, flexible, stretchable, epidermal microfluidic device (3D-epifluidics) able to attach to human skin for sweat collection. These 3D-epifluidic devices are an excellent platform for electrochemical and colorimetric analysis in support of non-invasive health monitoring. This work leverages a stereolithography (SLA)-based 3D printing process to develop high-resolution microfluidic channels that improve the controllability of capillary burst valve geometry in a low-cost platform. This controllability allows for tunable fluid routing options, which shows comparable capability to more expensive cleanroom fabricated options. Wu demonstrated fully encapsulated, 3D-epifluidic devices for epidermal interfacing in stationary exertion tests and notes that modifications to adjust burst pressures could be easily incorporated to account for sensing in increased intensity workouts. This work was presented in Symposium MF02 on 3D Printing of Passive and Active Medical Devices.

During the poster sessions, Thi Kieu Ngan Pham—a doctoral candidate in Joseph J. Brown’s group—presented research on the fundamental interaction between gas and solid surfaces, specifically thin film, and its application to gravimetric gas adsorption, gas/vapor sensor, and H₂ storage. The poster was presented in Symposium NM01 on Beyond Graphene 2D Materials—Synthesis, Properties and Device Applications. Takuya

Society News
Wise—a master’s candidate in Woo-chul Lee’s group—focused on thermal storage systems, nanofluids applications, and energy conversion. Wise created an operable transient hot-wire test bench that is capable of measuring thermal conductivity of fluids that will help determine which type of nanofluid mixture will enhance a custom-designed solar water heater system that is currently in the development phase in Lee’s laboratory. This poster was presented in Symposium SF13—From Actuators and Energy Harvesting Storage Systems to Living Machines.

For more news coverage

Some of the key talks that were delivered in Honolulu and livestreamed online were preserved on video and made available to registered attendees for nearly a month after the Meeting ended, as were the prerecorded presentations. Look for articles based on presentations from the Meeting in future issues of MRS Advances, an archival, peer-reviewed journal reporting snapshots of work in progress on key materials topics identified by leading-edge MRS Meeting programming. For more news on the 2022 MRS Spring Meeting & Exhibit, see the MRS Meeting Scene® at www.mrsmeetingscene.org and subscribe to the MRS Meeting Scene newsletter by creating an account at mrs.org.

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