SUMMER 2015 NEWSLETTER

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WELCOME TO OUR SUMMER 2015 NEWSLETTER!

Although Congress is in summer recess, several activities have developed since spring that impact Congressional legislation to support science and technology. The MRS Government Affairs Committee (GAC) aims to understand the dramatically changing policy environment and its impact on materials research. Our MRS Director of Government Affairs, Damon Dozier, describes the significance of these events—describing in detail the status of appropriations bills affecting support for science across agencies, bills to advance sustained support for science as well as new programs, the latest on efforts to reduce federal employee travel restrictions, as well as MRS efforts that support these initiatives. Our new Government Affairs Committee Chair, Kevin Whittlesey, outlines a wide range of new activities that GAC will pursue this year. Grassroots Chair, Brent Carey, emphasizes the importance of MRS members’ engagement with our lawmakers to bolster support for energy-critical elements legislation and COMPETES reauthorization. Our new Congressional Fellows Chair, Gavi Begtrup, introduces this year’s new Fellows, their initial activities, and the amazing Fellows Alumni network that has developed over two decades. Linda Olafsen provides a preview of the GAC Congressional Visits Day activities scheduled for next month and the positive impact of our CVD members with legislators. David Norton outlooks the exciting program he’s organized for government agency presentations at the MRS Fall meeting in Boston and topics of high interest to each agency. Finally, Orlando Auciello’s INTERSECTIONS article on value-added materials science in this issue features yet another success story, highlighting how investments in materials science paid off in ways that the general public and especially our elected officials can relate to.

MRS is working hard to make sure that the materials research community is being heard and that it has input in developing effective government policy for support of materials science. Here is the latest news.

GREETINGS FROM THE GAC CHAIR

Kevin Whittlesey
Chair, Government Affairs Committee

As the summer comes to a close, I am excited to be entering my first fall season as Chair and what is sure to be an interesting and busy time for the GAC. Damon Dozier has quickly come up to speed on our advocacy activities and is continuing the Society’s great work in Washington. As our activity expands, I’m certain that our investment in having a full-time, permanent presence in Washington continues to pay dividends.

On August 31 we welcomed the incoming 2015-2016 MRS Congressional Fellows at their kickoff breakfast, and in October members of GAC and MRS Leadership will be returning to Washington as part of a delegation to visit Congressional as well as key Executive Branch agency offices that are important to the materials science research community. These direct advocacy visits are of course vitally important to our efforts.

Looking farther into the fall, as usual the GAC will have a strong presence at the 2015 MRS Fall Meeting. We will once again host talks by government agency representatives about funding opportunities, an information session about the Congressional Fellowship program, a policy forum, and manage the Materials Voice booth to enable members to write advocacy letters to government leaders. The GAC will also be holding our typical luncheon meeting, in addition to a strategic planning session for GAC leadership, to identify and prioritize our agenda for the coming year.

In an important development for the GAC, we recently obtained approval by the MRS board for the first policy study to be conducted by our new Policy Subcommittee around the topic of open data policies and the implication for researchers. This is an exciting new project as it marks new territory in our expanding advocacy efforts. Policy studies can be critically important for raising awareness around particular scientific issues and make recommendations which can directly influence
new policy and the research environment. While conducting and authoring such studies can be time consuming, they are important vehicles through which input can be provided to law makers on particular science policy issues and can be quite impactful if they are timely, thoughtful, and actionable. I am pleased to see MRS exhibiting leadership and initiative in this area.

Looking into the next year, I will be taking a close look at our current activities and how we can improve upon our already very strong programs. I have great interest in expanding our outreach efforts to try to engage more members and volunteers in advocacy and to educate our broader membership about what GAC does on their behalf. I believe there are opportunities for MRS to exercise real leadership in the science advocacy space and take positions on issues in which maybe we haven’t historically been involved. In this highly-dynamic environment and moving into the election cycle, MRS needs to be able to respond to emerging policy issues in a timely and responsive way. These are issues which I look forward to working with MRS leadership as new opportunities for GAC to further add value to the MRS as a member-based organization. As always, I thank all of our many volunteers for their hard work and am excited to implement some of the great ideas and suggestions I have received and continue to expand our reach over the coming months and years.

WHAT’S HAPPENING IN WASHINGTON

Damon Dozier  
MRS Director of Government Affairs

After an eventful spring legislative session, Congress is currently in summer recess. On the budget and appropriations front, the House is more active than the Senate, having passed six appropriations bills: Commerce/Justice/Science (CJS); Defense; Energy and Water; Legislative Branch; Military/Veterans; and Transportation/HUD. The Senate has not passed any appropriations bills to date. All of the bills passed by the House assume sequester-level spending, which translates into lower funding levels for non-defense domestic spending.

The Administration has threatened to veto any funding bill that adheres to sequester-level spending, citing a need for increased money for domestic priorities. Several of the bills passed by the House have been subject to critical Statement of Administration Policy (SAP) statements indicating the President will veto them if enacted into law in their current form, so there is talk of a potential shutdown again this year. Additionally, and potentially adding to the prospect of a government showdown over expenses, Treasury Secretary Lew sent a letter to Congress on July 29 noting that the agency has been utilizing “extraordinary measures” since March 16 to avoid the US going over its statutory limit on borrowing (also known as reaching the “debt ceiling”) and that these measures could last until late October before presumably action must be taken.

As a result of our government relations outreach efforts, MRS was asked to support Rep. Swalwell’s (D-CA) Securing Energy Critical Elements and American Jobs Act of 2015. Briefly, the bill would establish in the Department of Energy (DOE) a research, development, and commercial application program to assure the long-term, secure, and sustainable supply of energy critical elements to satisfy the national security, economic well-being, and industrial production needs of the United States. This would be done by directing the Secretary of Energy to: (1) support new or significantly improved processes and technologies (as compared to those currently in use in the energy critical elements industry); (2) encourage multidisciplinary collaborations and opportunities for students at institutions of higher education; (3) collaborate with the relevant agencies of foreign countries with interests relating to energy critical elements; (4) establish a Research and Development Information Center to catalogue, disseminate, and archive information on energy critical elements; and (5) submit an implementation plan to Congress.

Another bill that MRS endorsed, the Smart Manufacturing Leadership Act, was marked up and passed favorably by the Senate Energy Committee as part of a comprehensive energy package. The bill was sponsored by Senator Shaheen (D-NH) and Senator Alexander (R-TN), who was the Republican lead. The passed provisions provide an avenue to create and deploy smart manufacturing technologies and improve the productivity and energy efficiency of the manufacturing sector, especially among small and medium-sized businesses.

In other legislative action, late last month, Senators Peters and Gardner of the Senate Commerce Committee announced that they would hold a series of “listening sessions” about COMPETES reauthorization and invited interested groups to comment by August 21. Topics for the roundtables include: (1) maximizing basic research; (2) improving science, technology, engineering, and math (STEM) education research and practices for students; and (3) translating federal research results into innovative commercial applications for the benefit of the economy and society. Two roundtables have already been held, and MRS has prepared comments for the listening/working group.

About a month ago, Senators Schatz and Coons offered and withdrew a conference travel amendment during the full committee markup of the FY 2016 Financial Services and General Government appropriations bill. The amendment mirrors what was included in the Senate CJS appropriations bill and would have inserted language allowing OMB to revise M-12-12. MRS signed on to a letter thanking the Senators for their efforts, and continues to advocate for expanded opportunities for government employees to attend scientific and technical conferences. Conversations with the offices of Senators Cochran, Schatz, and Coons and with committee staff give
indications that there will be a significant effort to have that language included in any final spending measure. However, success is far from assured.

Finally, the GAC reminds readers that MRS has added two social media accounts to provide members with up-to-date information on what is happening in the domestic and international policy sphere. You can track policy news on Twitter by following @MaterialsSciPol and “like” us at Facebook on our Materials Science Policy page.

**PROVIDING CONTEXT FOR IMPORTANT R&D LEGISLATION**

Brent Carey  
Chair, Grassroots Subcommittee

As preparations continue for the 2015 MRS Fall Meeting, critical legislation with substantial implications for R&D is taking shape as it works its way through the U.S. House & Senate. Damon has provided some overview in his article, but I thought I would take a few moments to highlight the importance (and relevance) of these bills—and how you can help!

The *Securing Energy Critical Elements and American Jobs Act of 2015* would authorize the Department of Energy (DOE) to establish resources that would help mitigate some of the challenges that have arisen from the use of energy-critical elements. Examples include the lithium that enables the high energy density in lithium-ion batteries, and the neodymium which is the functional element in the magnets that make hybrid vehicles and wind turbines possible. These are applications that touch all of our modern lives, so don’t hesitate to share with others the importance of these elements—those with smartphones can certainly appreciate the frustration of a dying battery, but they may not be aware that materials will be the key for longer battery life in the future!

Congress is also taking a look at reauthorizing the America COMPETES Act, to help preserve U.S. leadership in STEM fields and STEM education. This legislation serves as a “roadmap” for STEM in Congress, putting a focus on these crucial technical fields to ensure that there is a pipeline of talent coming through our colleges and universities, as well as adequate federal funding to support the conceptualization, development, and deployment of novel technologies for societal benefit. Without reauthorization, STEM is likely to slip on the list of legislative priorities. This is especially perilous during these times of budget battles and fiscal austerity.

These are topics that have major importance for the majority of MRS membership, so your involvement is really important! Keep your eyes peeled for the Materials Voice kiosk at the Fall Meeting, and be sure to stop by to send the letters to your representatives in support of these important bills.

**MRS CONGRESSIONAL SCIENCE & ENGINEERING FELLOWSHIP CORNER**

Gavi Begtrup  
Chair, Congressional Fellows Subcommittee

Hello! I am Gavi Begtrup, the new Chair of the Congressional Fellows Subcommittee, stepping into Kevin Whittlesey’s shoes. I was the 2009-2010 MRS/OSA Congressional Fellow and served my fellowship in the Office of Congresswoman Gabrielle Giffords (D-AZ). I was subsequently hired on as Policy Advisor for Congresswoman Giffords and served with her for the remainder of her time in office. I have relocated to Cincinnati, OH where I am now the CTO of Eccrine Systems, Inc., a startup developing wearable sweat sensors to remotely and non-invasively monitor human physiology. I am thrilled to be chairing this Subcommittee and contributing to the fellowship program that has been so transformative in my own life.

It is my pleasure to welcome our new Congressional Fellows, Peter Winter (MRS/OSA) and Jeremy Ward (MRS/TMS), who just started their 2015-2016 fellowship year. We gathered in Washington, DC on August 31 with 14 former Congressional Fellows for our annual kickoff breakfast, a chance to welcome Peter and Jeremy, introduce them to this wonderful network, and share our experience in advance of their year working as legislative fellows in Congressional offices.

Peter and Jeremy will now participate in a two-week-long science policy orientation program organized by the American Association for the Advancement of Science to provide an introduction to the policy and political landscape before they begin interviewing with Congressional offices to find their placement for the duration of their fellowship year. Look for an update in a future issue of *INTERSECTIONS* for information on their placement offices and policy issue areas!

The new Fellows are the 27th and 28th that MRS has sponsored or co-sponsored, and represent the 21st year of the fellowship. The growing fellowship alumni network boasts leaders in positions across the spectrum including academia, industry, startups, government and policy, as well as a number who have remained on the Hill in various capacities.

Already looking towards next fall, the application process for the 2016-2017 fellowship term is now officially open. Information on how to apply for the MRS/OSA and MRS/TMS Congressional Science and Engineering Fellowships can be found at www.mrs.org/congressional-fellows. Stay tuned in the next issue of *INTERSECTIONS* for an update on where our
2014-2015 Fellows, Adria Wilson and Jimmy O’Dea, have gone since the conclusion of their respective Fellowship terms.

CONGRESSIONAL VISITS DAY, BROADER IMPACT

Linda J. Olafsen  
Chair, Congressional Visits Day Subcommittee

The Congressional Visits Day (CVD) Subcommittee has been preparing for a fall visit to Washington, DC. Most participants are members of the MRS Executive Committee and Board of Directors, and they will have the opportunity to learn more about the important activities of the GAC broadly and about CVD specifically. A few board members are returning as they have appreciated the importance of these visits and the need to deliver a consistent message to Congress. Participants are coming from California, Colorado, New Mexico, New York, Pennsylvania, Tennessee, Texas, and Washington. Of particular note is our opportunity to visit the offices of six new members of Congress. The CVD Subcommittee has been prioritizing visits to the offices of new members of Congress to make sure that they are aware of the importance and impact of federal funding of research, as well as acquainting them with MRS and how the Society and MRS members in their districts may serve as resources to the congressmen and senators.

The CVD Subcommittee continues to follow up on new contacts and opportunities from the spring visits to Capitol Hill. A visit to Senator Jeanne Shaheen’s office by constituent Ulrike Wegst (Thayer School of Engineering, Dartmouth College) led to MRS working directly with former Congressional Fellow Ariel Marshall on Senator Shaheen’s Smart Manufacturing Leadership Act. Key provisions from this Act provide an avenue to create and deploy smart manufacturing technologies and improve the productivity and energy efficiency of the manufacturing sector.

PREVIEW OF THE 2015 MRS FALL MEETING: MEETING THE FEDERAL AGENCIES THAT SUPPORT MATERIALS RESEARCH

David P. Norton  
Chair, Government Agency Subcommittee

At this year’s MRS Fall Meeting at the end of November, the GAC will host the Government Agency Presentations at which representatives from federal agencies that support materials research will describe programs and funding opportunities. These presentations should be of significant interest to the materials research community attending the meeting. We have invited representatives from the National Science Foundation, the Department of Energy, the Department of Defense, and other federal agencies to participate. Each will make presentations, entertain questions from the audience, and be available for one-on-one interactions. While the focus is on funding for US researchers, we hope to include discussion of programs that are international in scope, providing opportunities for participants both within and outside the US. This venue should provide individual researchers insight into how their research interests align with agency missions and identify opportunities to secure funding support. The sessions will be held on Tuesday and Thursday evenings, making it convenient for attendees to participate in the technical sessions and also attend this informative exchange.

While the principal purpose of the Government Agency Forum is to connect researchers with funding agency representatives, it will also serve as an opportunity for members of the materials research community to better understand the importance of these agencies in supporting basic and applied research and to see how they might advocate for federal investments into research. These agencies intersect research activities within academia, national laboratories, and industry. Stakeholders in universities, industry, and R&D laboratories
stand to benefit from national investments in the research enterprise both within and outside the US, whether it is supporting high-risk, high reward research, long-term fundamental studies, or early career scientists who represent the next generation of discoverers. Federal governments are increasingly interested in the translation of research into innovative commerce applications. Whether it is recent breakthroughs in biomaterials or nanomaterials, insights into mechanical, electronic, or photonic behavior, or applications centered on energy or sustainability, these agencies are critically important in supporting our community.

A VALUE-ADDED MATERIALS RESEARCH STORY

Formation and Growth of Advanced Diamond Technologies

Orlando Auciello,
Professor, University of Texas at Dallas

Thin films based on nanostructured materials made of carbon atoms have shown tremendous potential, since the 20th Century, for translation of the laboratory science into technologies improving peoples’ way and quality of life worldwide. In this respect, a novel ultrananocrystalline diamond (UNCD) material originally developed (1990-2003) in thin film form and patented by Auciello, Gruen, Krauss, and Carlisle at Argonne National Laboratory (ANL), provided a new paradigm in materials science and materials integration for fabrication of a new generation of macro / micro /nanoscale devices with multi-functionalities. UNCD films (coatings) are synthesized by novel microwave plasma chemical vapor deposition (MPCVD) and hot filament chemical vapor deposition (HFCVD) techniques using a patented Ar (99%)/CH₄ (1%) gas chemistry. C₂ dimers and CH radicals, formed from cracking CH₄ molecules in the MPCVD process, or upon hitting an array of parallel filaments heated to 2000 °C, via electrical current flow, in the HFCVD process, induce growth of diamond films with 2-5 nm grains size, thus the name UNCD coined by the original developers, to distinguish them from nanocrystalline diamond films with 10-100s nm grains size, grown using prior H₂ (96%)/CH₄ (4%) gas chemistry. UNCD films exhibit unique combination of outstanding mechanical, tribological, electronic, thermal and biological properties, namely: 1) highest hardness (98 Gpa) and Young Modulus (998 Gpa), similar to single crystal diamond (100 and 1100 GPa, respectively), and lowest coefficient of friction (~ 0.02-0.04), compared to other diamond or nanocarbon-based coatings; 2) high electrical conductivity induced by nitrogen atoms insertion in grain boundaries (N-UNCD), satisfying dangling C atoms bonds and providing electrons for conduction, or via Boron atoms substituting C atoms in the diamond lattice (B-UNCD), providing electrons to the conduction band; 3) low thermal transport for use as thermal insulating coating; 4) outstanding biocompatibility including resistance to chemical attack by body fluids, and 5) excellent surface chemistry as biological interface for stem cells growth and differentiation for tissue engineering.

The UNCD coatings are commercialized in industrial products by Advanced Diamond Technologies (ADT), a company co-founded by Auciello and Carlisle (Romeoville, Illinois, 2003-present), which is the exclusive licensee of all the original UNCD patents from ANL and subsequently developed new IP. ADT raised about US$ 15 million in grants and about US$ 14 million in Angels funding (2003-present), becoming profitable in 2014 and creating 25 high-tech and 5 administrative jobs in the Midwest. ADT’s UNCD-based products include (Fig.1): 1) UNCD-coated seals for mechanical pumps used in the petrochemical, pharmaceutical and mining industries among others, reducing cost due to 3 to 10 times longer seal lifetime (shipping to a market valued at ~ US$ 3 billion); 2) UNCD-coated bearings for pharmaceutical drug mixers (shipping to a market valued at ~ US$ 500 million); 3) Water purification system with corrosion resistant B-UNCD-coated metal electrodes for electrolysis-based purification (shipping to a market valued at ~ US$ 80 billion); 4) UNCD-AFM tips for scientific applications (shipping to a market valued at ~ US$ 20 million); 5) UNCD-coated silicon wafers for customers developing new generation of MEMS/NEMS devices superior to Si-based MEMS/NEMS. Developed high-tech devices include RF-MEMS switches with UNCD dielectric layer, integrated with CMOS drivers for next generation of radars and mobile communication systems (prototype demonstrated).

Recently, Auciello and Gurman (MD) co-founded Original Biomedical Implants (OBI, 2013-present), which raised ~US$ 200,000 (2014-15) from customers to start developing UNCD-based new generation of medical devices (Fig.1) based on biocompatible/bio-inert UNCD coatings, namely: 1) UNCD-coated super-paramagnetic nanoparticles coated magnets temporarily located outside the eye, producing magnetic fields to attract super-paramagnetic nanoparticles

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injected in the eye to push detached retina back into place (clinical trials with M. Saravia (Austral Hospital)- A. Berra (University of Buenos Aires-Argentina), and R. Zysler (CONICET-Argentina) started in Argentina-April 2015- with first patient regaining normal vision); 2) UNCD-coated dental implants (animal studies with colleagues in Argentina (M. Guglielmotti and D. Olmeddo, University of Buenos Aires-Argentina) successful, 2012-2015); 3) New Li-ion batteries (LIBs) with UNCD-coated anodes and other components (with T. Tzeng- NCKU-Taiwan), enabling a new generation of LIBs with ≥ 10x longer life and safer than current LIBs, for pacemakers/defibrillators, cell phones and other electronic devices (prototype UNCD-based LIB demonstrated); 4) UNCD scaffolds for stem cells growth and differentiation enabling tissue engineering and regenerative medicine; 5) UNCD-coated eye fluid drainage device for treatment of glaucoma (increased intraocular pressure) (advanced animal studies were performed with colleagues (Saravia/Berra) in Argentina).

FEEDBACK

We welcome your feedback and invite you to submit topics for consideration in future issues of this newsletter. If you have or know of stories that illustrate how an investment in materials research paid off in real dollar terms, please send your suggestions to INTERSECTIONS Editor, Len Brillson, at brillson.1@osu.edu. Please send your comments to publicaffairs@mrs.org.

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