We're Hadi Fares, the 2015 ACS ChemChamps winner, and Dr. Joseph Schlenoff, Senior Editor of ACS Langmuir, here to talk to you about polyelectrolytes research and science communications, AUA!

AmerChemSocietyAMA [1] and r/Science AMAs[1]

[1]Affiliation not available

April 17, 2023

Abstract

Hi Reddit, We are Hadi Fares, chemistry PhD candidate, and Joseph B. Schlenoff, Leo Mandelkern Professor of Polymer Science at Florida State University and Senior Editor of the ACS Langmuir journal. We will answer questions about our research focused on polymer materials as well as the ChemChamps competition organized by the American Chemical Society. Joseph Schlenoff (JBS): I am a chemist interested in polyelectrolyte and zwitterated interfaces and their bioapplicability. Polyelectrolytes were thought to be un-processable until a couple of decades ago. We have discovered ways to process biocompatible synthetic polyelectrolytes using salt instead of heat. Salt helps in exposing the charged sites in these macromolecules, making it easier to extrude them to form different shapes such as tapes, tubes and rods, or to deposit them using the layer-by-layer (Lbl) technique or spin-coating. Hadi Fares (HF): I am interested in charge compensation and diffusion inside polyelectrolyte films and complexes. We found a way to eliminate salt trapped in polyelectrolyte multilayers during buildup to obtain stoichiometric uniform thin films (few hundreds of nanometers). Using this new platform, I'm currently studying polyelectrolyte diffusion in these films in an attempt to make better materials and understand the way polyelectrolytes behave in complexes. These films have been proposed for uses as coatings and reservoirs in fields ranging from electronics to medicine. I'm also the winner of last year's "Chemistry Champions", a science communication competition organized by the American Chemical Society. Besides the many lessons I learned about communicating science, the competition has allowed me to travel to attend a public briefing on science education policy on Capitol Hill in Washington, DC. I also shot an upcoming "ACS Reactions" (https://www.youtube.com/user/ACSReactions) video about why we salivate when we see food (my favorite topic). You can read more about my ChemChamps experience in this blog post (https://speakingaboutscience.wordpress.com/). I will also be answering questions about this year's edition of the competition starting soon. Every chemist 35 or under should apply!! Feel free to ask us anything about polyelectrolyte materials, life in graduate school or ChemChamps! We will be online at 11:00 am ET (8 am PST, 4 pm UTC) to begin answering your questions. [EDIT] 11:00am ET, I am online to answer your questions. Thanks for the participation! - HF [EDIT] 12:00pm ET, I answered some questions. We will be back at 1:00pm ET to answer more. Thank you! -HF [EDIT] 1:00pm ET, I am online to answer more questions -JBS

the WINNOWER

REDDIT

American Chemical Society AMA: We're Hadi Fares, the 2015 ACS ChemChamps winner, and Dr. Joseph Schlenoff, Senior Editor of ACS Langmuir, here to talk to you about polyelectrolytes research and science

AMERCHEMSOCIETYAMA R/SCIENCE

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READ REVIEWS

WRITE A REVIEW

CORRESPONDENCE:

DATE RECEIVED:
February 17, 2016

DOI:

Dear Mr Fares and Dr. Schlenoff,

just out curiosity I have a somewhat of a personal question. Why chemistry? Personally I'm studying medicine and find everything about the human body fascinating and understand how someone can have a passion for something. But why chemistry, what sparks that passion for you guys?

NerpFlerp

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Chemistry is what underpins medicine. Like learning how to drive a car then opening the engine to see how it really works.-JBS

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NerpFlerp

I did my BS in Biochemistry and did some research on cancer in a pharmacology MS. What attracted me the most to Chemistry is that it's a central science that is used in many other fields. I am more and more interested in the fundamentals and figuring out how things work on the molecular level. I find it very exciting that we are discovering critical aspects of polyelectrolytes and multilayers although these topics have been studied for decades. This not only expands the basic knowledge but it also opens doors for improvement in our field (better materials) and others (applications in biology, medicine, electronics,..) - HF

In your opinion(s), what is the most important thing the public should know about polyelectrolytes?

netseW

That they are literally everywhere! They are used in shampoos, cosmetics, concrete mixtures, treating oil and water... and they can have many more applications in the future. Mixing and processing them gives new materials (films, tubes, gels,..) that are studied for uses that range from protecting implants against bacteria to preventing corrosion of metals. -HF

It is my understanding that plants crave electrolytes. What are your thoughts on switching to using a sports drink to water crops so as to give pants more of what they crave?

But seriously, what are your thoughts on open access publishing? Do you think the ACS is doing enough to create lower-cost options for junior faculty to publish open access without hitting their startups hard?

FartBoxCutter

ACS no longer charges authors for publishing or for color figures. Institutions subscribe to the whole suite of ACS journals with no cost to faculty. The major cost of startups is really pricey equipment! Even the smallest widget can be $10K - JBS

Question for Joseph.

After extrusion/processing of your PEs, do they change upon exposure to water? Dissolving the salt away might cause some undesirable effects.

Ionic_liquids

When you immerse them in water the salt is washed away and you get tough, elastic materials. Some have the mechanical properties of tendon or cartilage!

When they dry they become brittle. - JBS

First, I would like to learn more about the process. I'm a chemical engineer with some background in graphene LbL assembly. Do you have a link to some of your publications?

And onto some questions.

For JBS: So the salt solution used to make the zwiterions soluble for processing, but how durable are these materials that are deposited into the surface? Would a saline solution cause the layers to decay? Especially considering bioapplicability, where the human environment is basically covered in salt solutions.

Also, what applications would these biocompatible materials have? Are you thinking more in the medical device area or the pharmaceutical/biotech space?

For HF: There have been a lot of efforts to make education more accessible. For computer science, it's pretty easy to just open up edX, Khan Academy, or CodeAcademy and learn a new language. But for Chemistry, Applied Chemistry, Biology, and Physics, it's much more difficult to create engaging online courses. What do you think is the best way to change science education?

Thanks!

amazn_azn

Concerning the processes, here are some representative publications about the layer-by-layer deposition which can also be done by spraying. They can also be extruded into many shapes or spin-coated after obtaining coacervates using salt. -HF

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amazn_azn

If you pick the right combination of polyelectrolytes you get a nice biocompatible coating that is hydrated but stable in the presence of salt. - JBS our pubs are at http://www.chem.fsu.edu/~schlen/pubs.html

Are there any restrictions/frown-upon's for undergraduates applying to Chem Champs regarding their research? Regarding the element video, were there any restrictions given to that video? I am surprised to find that nobody happened to play with the elements themselves in the lab.

Take care!

LifeisElemental

Not at all! Anyone under 35 can apply. Undergraduate participants made it to the semifinals and the finals last year. Regarding the element video, there weren't any restrictions about the video except that the preparation time was very limited. We were given a day to list our favorite elements and then were assigned one element according to a draft system. We then had only few days to make the video and submit it. - HF

Can polyelectrolyte materials be used to regulate the flow of ions in fuel cells? What about nano-filtration/reverse osmosis separation processes?

golvellius07

Yes to fuel cells and especially yes to nano-filtration. Please consult the work of Paula Hammond at MIT and Merlin Bruening at Michigan State. - JBS

For the spin coating method, is it possible to lower the viscosity enough to fully penetrate a porous electrode layer for battery applications?

Mick_Lance

The viscosity is incredibly sensitive to salt concentration (viscosity ~ $[salt]^{28)}$, the lowest viscosity is about 10 x that of water so you should be able to soak into a porous electrode or membrane. - JBS

In principle, could these materials be applied to the creation of artificial muscles?

q24blue

They are pretty tough but the key to muscles is that they contract. So far, we think the complexes can be used for wound dressing, artificial cartilage, sustained release (implants), cell growth and other biomedical applications. - JBS

I usually hear about the importance of science communication in the medical field due to its wide applicability and public interest. How (if at all) can we make science communication in chemistry more accessible for readers without a strong scientific background? Do you feel like this is worthwhile? (I do)

undermyerinella

I think science communication in chemistry is necessary! The non scientist public funds science and needs to follow the progress. And not only it also has a wide applicability in our everyday life (see ACS Reactions) but it is important for the non scientist public to be able to independently separate the fiction from reality in a lot of pseudoscience news online (or on social media). -HF

What is your opinion on the peer review process, specifically by ACS pubs and/or in general?

If negative, how would you propose to change it?

If positive, what about stupid buzz words and reviewers who don't know what they are talking about blocking good research?

Thanks!

ferr0cene

Reviewing is an imperfect process but, at least for the reviewers who have helped me, you get a good analysis of the work. We editors see buzz words so frequently they no longer have much effect on us. - JBS

Hi my name is Adam and I'm currently an undergrad chemistry major. My question is, what inspires you to take this specific research. Is it given to you as an opportunity to work on this project? Or did you wake up one day and say "I wanna study polyelectrolytes!" I've done research at Brookhaven national lab at the NSLS but on a commercial group research study. How do you find your field? I'd love to submit my own grant.

Kalkanis

Adam, you definitely have to follow what interests you the most then decide to make a significant contribution. The path of academic researchers can be pretty meandering ie. random but we are driven by curiosity - JBS