



The COVID-19 pandemic



The current pandemic brought on by the novel coronavirus that causes COVID-19 has certainly altered our world and our way of working. *MRS Bulletin* has opened this column of Questions and Answers (Q&A) in order to publish the experiences of members of the Materials Research Society during this time.

Haiyan Wang

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How will the current environment fundamentally change the way in which materials research will be done in the future?

I am a professor of MSE [Materials Science & Engineering] at Purdue University and a hardcore experimentalist working in the area of epitaxial thin-film growth, functional ceramic nanocomposite designs, and transmission electron microscopy. Unfortunately, every part of our work requires physical lab access. Having worked as a technical staff member at Los Alamos National Laboratory for three years and as a faculty member for more than 15 years, I have always enjoyed the great fun and joy of experimental new materials discoveries by myself and with my students and postdocs. However, the current COVID-19 pandemic has changed everything in my entire research group (15 PhD students and postdocs). All of a sudden, we have realized that being able to work in the labs physically has become

a “luxury” and is nearly impossible. We once even dreamed that we were a modeling group and could conduct a large portion of research on computers. Now we are working on standard operating procedures for each lab with every detail imagined to prevent social interactions and to ensure our students have a safe research environment. We are expected to return to the labs in mid-June.

As a faculty member, I have tried to devote more time to meet with students and postdocs (virtually for sure), go through their data, and plan their future research more effectively, as the concept of trial-and-error experimental design is no longer possible since lab access is limited by social distancing requirements. Currently, all equipment training has to be postponed due to social distancing. We are actively planning for virtual training and video recordings for new students and users. I believe students need our help and support to stay focused. I am not sure how long this pandemic will last, but it has significantly altered our research plans in 2020 and will perhaps impact all of our work even longer.

What is one significant way the materials community can contribute to overcoming the current COVID-19 pandemic?

We shall support our students and colleagues and actively seek potential research directions that would impact the pandemic. We might have to be more flexible in our research plans and goals. We also need to plan for delayed project deliverables and effectively plan for future research to minimize the impacts of the delays.

As materials scientists, we all can contribute directly or indirectly to one or more of the research areas related to the pandemic, such as the development of personal protective materials, sensing and detection devices and materials, materials for expedited diagnoses, and materials for effective separation and drug delivery. We

are all materials discoverers and explorers, and critical materials discoveries that could lead to a game change in this pandemic and future ones could come from one of us!

What are your additional thoughts on the current situation and how it has altered our world and life?

The pandemic has changed our teaching and mentoring efforts significantly. At Purdue, we are currently hosting all summer classes online, and all of the major meetings and activities are canceled. We have also scheduled all final theses defense and project meetings virtually in the summer. Effectively conducting online teaching and mentoring for our students has become an essential skill set for all of us.

How we think and react positively and proactively to the pandemic will impact a lot of people around us, including members in our own research group, faculty or staff in our institutions, the students in our classes, and our family.

Tae-Woo Lee

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What are you (and your research group) doing differently to continue research during the COVID-19 pandemic?

Actually, in terms of research activities in our group, there is not much difference between the pre-COVID-19 and post-COVID-19 situations, except that we are much more cautious about the COVID-19

disease and not attending conferences. Important meetings, such as research funding evaluation meetings, can be conducted while maintaining self-protection guidelines. This situation is similar throughout South Korea.

I am encouraging our students to be safe all the time. In the laboratory and students' offices, I am checking that they are wearing a face mask (KF94 grade) and using a hand sanitizer whenever they enter the office. Especially, we are very careful about visitors. They need to wear a mask and use a sanitizer. It is very important to keep social distance and air ventilation in the meeting rooms. We have tried to avoid meetings with people from outside the university, and instead we use the telephone, email, and Zoom or Skype for meetings. Even for meetings with students and collaborators, I am frequently using Skype. Currently, we are doing regular research here. Infected persons have not been found in our university.

What is one research topic/area that the materials community can focus on over the next 3–5 years to prevent future pandemics?

Of course, the development of a vaccine and medicine for prevention and remedy is the most important. Additionally, I think that if everybody in the world wears a face mask, uses a hand sanitizer, and keeps social distance, the pandemic situation will eventually be resolved. Self-prevention during the pandemic situation in our daily life is very important. Quarantine is not an ideal solution because it destroys people's regular daily life activities and eventually social, scientific, and economic progress in the world. Therefore, antiviral polymer fiber materials which can be used for mask filters in personal face masks, air conditioners, and other air ventilation systems can be good research topics.

How are you coping with not being able to attend scientific conferences in person?

Canceling scientific conferences around the world will be a challenge to share technological progress and for scientific discussions. Instead of on-site confer-

ences, we may occasionally attend online conferences. In addition, we hold small-size group meetings to share and discuss recent research progress and trends after individuals in our group read relevant research articles and prepare slides. These can be a good alternative to conference participation.

Amit Misra

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How will the current environment fundamentally change the way in which materials research will be done in the future?

Better appreciation for balancing the time spent on research. The time committed to reading (and understanding) literature, critically analyzing data (including data in literature), and writing thoughtful, substantive articles should be valued more than time spent on collecting experimental data and attending meetings and traveling.

What is one significant way the materials community can contribute to overcoming the current COVID-19 pandemic?

Innovate engineered materials such as barriers to block and deactivate the released virions before they reach the respiratory tract, biodegradable personal protective equipment, smart coatings to engineer self-sanitizing surfaces, portable rapid turnaround diagnostics, etc.

What are your additional thoughts on the current situation and how it has altered our world and life?

The current situation has been a “reset button” for humanity. As we slowly

reboot, we should reflect on people, activities, and things that define our quality of life and make us happy, and prioritize these in the future when we are allowed to travel freely again.

Andy Tay

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2017 MRS Bulletin Postdoctoral Publication Prize recipient*



What are you (and your research group) doing differently to continue research during the COVID-19 pandemic?

I am starting my lab at the National University of Singapore, and the pandemic has delayed renovations. My students and postdocs may also be delayed in starting their research work, as the university is closed to nonessential research. I am adapting by writing grants at home and attending virtual conferences to get fresh ideas.

I am also writing articles that may be useful for the pandemic. With Nature Index, I am writing about how researchers can coordinate remote collaborations and fight the pandemic beyond their bench work. I am also creating a resource kit with *The Scientist* magazine for scientists interested in creating virtual lab tours for students so that they can make better decisions regarding the labs they want to join. With the scientific journal *eLife*, I am highlighting the financial and mental health support we need to provide for incoming PhD students (elifesciences.org/articles/59147). Finally, I contributed an article to *Lab Manager*, a magazine focusing on the practical aspects of lab work, about the use of bioreactors for vaccine manufacturing.



What is one research topic/area that the materials community can focus on over the next 3–5 years to prevent future pandemics?

The focus of my research group is immunoengineering—the creation of technology and materials to boost our immune systems. This is an area that the materials community can definitely contribute to, such as creating better materials to engineer immune cells or delivering drugs to target specific immune tissues in the body.

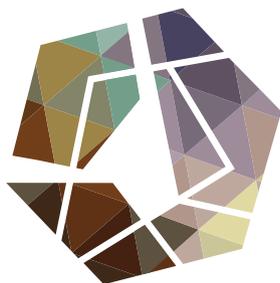
The materials community also has a very good chance to create translational impact in infectious disease diagnostics.

How are you coping with not being able to attend scientific conferences in person?

I have so far attended two virtual conferences, and I think they went pretty well, although it will still be nice to be able to meet colleagues in person. I was planning to attend a few conferences this year

but most of them have been canceled. On the bright side, the pandemic is a good time for the scientific community to evaluate how we can redesign physical conferences and value-added conference experiences when virtual conferences are advantageous in many ways, such as being more environmentally friendly and diverse (see this preprint on *bioRxiv*: “Evaluating features of scientific conferences: A call for improvements,” doi:10.1101/2020.04.02.022079). □

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