CERAMIC TECH CHAT

Episode 26

Title – "Advancing the Age of Glass: Mathieu Hubert (E26)"

INTRO

McDonald: "I'm Lisa McDonald, and this is Ceramic Tech Chat.

> We are now halfway through the 2022 United Nations International Year of Glass. Though six months of the year still remain, IYOG event organizers are already thinking about what comes after this year ends and how to carry the momentum built up by these celebrations to advance glass research and development in the future."

Hubert: "People don't realize how much things there still are to do in glass because you can talk to your great grandparents, they would have some stories related to glass because they had their own stemware, they had their own glass articles there, so it's easy to take it for a material from the past. Well, yeah, it has a very, very rich history, a very rich past, yet still very, very much a material of the future. There's so much things to do that we need a lot of people working on glass but also the related fields in glass and engineering, optics, metrology, and all these kinds of things."

McDonald: "That's Mathieu Hubert, glass development scientist and development program manager at Corning. Since joining ACerS in 2011, Mathieu has been heavily involved in the Society, from organizing sessions and symposia for the Glass & Optical Materials Division Annual Meeting and serving as a mentor in the mentoring program run by ACerS President's Council of Student Advisors.

> How does someone come to learn about and choose a career researching advanced glasses? And what are the challenges in educating more people about these materials and possible career opportunities?"
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> (music)

SECTION 1

McDonald: "Usually, when people think of glass, in general it's the more standard or traditional applications like bowls or windows. So, how did you come to learn about these advanced applications of glass and get interested in studying these materials?"

Hubert: "That's a bit of a journey overall because I used to study chemistry when I was at school. So working on materials, but never really any aspect of glass in itself. I ended up working on glass, I would say, a little bit by chance. I was working a summer stocking socks in boxes for, you know, just earning some money over the summer. And a very

good friend of mine from high school, his father is actually the person who created the glass lab at my local university in Rennes, France. And they called me and said, 'Hey, my father is looking for somebody as an intern to make glass over the summer, and he knows you're studying chemistry. Are you interested?' And I was like, 'It sounds way more interesting to me than socks.' No offense to socks, of course, but that's much better fit to what I was studying.

So I ended up working on glasses this way, and working on chalcogenide glasses for infrared applications. So very niche market, I would say in the glass world, but already starting to get more familiar with glass and glass-ceramics at that time for very specific applications.

And then one thing led to another, and as I progress through my studies and my career, I was more and more aware of all those things around. So, actually, after my Ph.D. focused on chalcogenide glasses, I ended up working for the glass industry, and I kind of realized, 'Hey, actually, I know a lot about those very technical glasses, but I don't know where my drinking glass is coming from, I don't know where my glass window is coming from.' And so, this is all I got also into more of these products. Okay, where are these bottles, drinking ware, screens for display, screens for cell phones came about. And, you know, there's a lot of things to do. There are these are products that are meant to not be seen most of the time or not to be noticed, yet they are critical to a lot of things that we're doing. And so, I just want to continue to learn more and more about these and one thing led to another. Right now, I'm working on phone screens type of glass because there's a lot of things that go in there. There wasn't a goal in itself for me to work on these materials specifically, but just that's where my career led me to work on them."

McDonald: "When you first started out at university studying chemistry, did you have an idea that you might want to go to a more industrial route in some way, or did that come later once you became aware of glass and all of its applications?"

Hubert: "That came later for me. Yeah, I liked the research aspect for sure. You know, in a Ph.D., that's what you are trained for. Actually, I was working on some synthesis methods for these chalcogenide glasses, so I had to first feel about, 'Okay, what is used to make those materials?' And then my first job was as a consultant for the glass industry, and then I get much more exposed to the glassmaking process itself and all the aspects of what other industry or glass furnace looks like, all the challenges people face there. And there's maybe a tendency to think that it's easy to make glass which, you know, in principle, yes, that's easy to make glass. You take sand, you take some other raw materials, you put at high enough temperature, you get glass. But getting good glass is a very different story. And actually this aspect of how do you make good glass out of it, how do you go from making a few grams of it to a few hundreds or thousands of tons of these per day in a single furnace and all the aspects there. That's something that I find really fascinating and that are really interesting to me.

So actually, in development, it's very my comfort zone, I would say, or the place I like to operate because I'm somewhere in between the two. I still have to interact a lot with more

fundamental research and people who work deeply in this field because I need to understand the products I'm working on. And then to get these are learning from them, but also get to accompany them to build a large-scale manufacturing and see how they behave in a glass melting furnace, and what are the challenges there, and how you would solve those challenges. So, these aspects are really interesting to me. So, on my own interests, these industrial aspects and the industry is really what attracted me. And I found a place where I can actually marry a little bit of both of my initial background in more scientific realm and my found interest in the glassmaking process in itself."

McDonald: "So, what's the story of how you came to be at Corning? Because you were originally in France and now you're in the United States."

Hubert: "Yeah, so actually, I also had a stop in the Netherlands in between. I did my studies on chalcogenides between France and I spent some time in Arizona as well before going back to France. And after my studies, looking for my first job actually I found a position at a company called CelSian Glass and Solar in the Netherlands. So I spent a few years over there more as a consultant for the glass industry. So doing some contract research for different aspects of the glassmaking process. So shifting from chalcogenides to oxide glasses, so that was a bit of a different world and quite a steep learning curve, but very, very interesting journey for me. I was also engaged in some teaching activities over there.

So I spent four years over there and then, after some time, I got an opportunity to join Corning. And joining in development, which, as I explained a little bit earlier today, is like kind of my comfort zone, somewhere between the research and manufacturing. And so, I wanted to try this challenge, so that's how I ended up there is just an opportunity came, that was a good opportunity for me at the time, so I decided to take that step. I spent a few months at Corning facilities in France before transferring to Corning in the U.S., and I've been here for a little bit over five years, upstate New York. So, it's just a journey with opportunities that came and finding the right fit for me at the right time. And so yeah, here I am."

McDonald: "Well, and that's always the goal is, you know, you never know where you're going to end up, but when you see opportunities, go for them."

Huber: "Exactly."

(music)

SECTION 2

McDonald: "So I know you spent your graduate studies doing a lot with chalcogenide glasses. Are those in application yet?"

Hubert: "So these are glasses that are already commercially available. There are a few companies around the world who produce and sell those glasses. You will find them on some thermal cameras, actually, like the lenses for thermal cameras. So that would be one of the main

applications, for thermal vision, some military applications as well. You have also some specialty fibers, for instance, I know some labs around the world and some recent companies as well have been working on making fibers out of these materials and to make some very specific spectroscopic devices to be launched in telescopes to look for traces of life, like water, ozone, and carbon dioxide, find traces of that on exoplanets. So there are some applications.

I don't think the volume that you will see in production is anywhere near what you'll have for oxide glasses. I read some numbers at some point that was like somewhere between twenty and thirty tons of these glasses produced over a year in the world. While a standard float furnace to make a window can produce over a thousand tons of glass per day. So we really look at that on a very different scale. But there is application, and I think if research continues on this, there's probably going to be more and more around this because a lot of applications in infrared are being developed, so there's going to be a need for more materials compatible to that, and chalcogenide glasses probably have a role to play there."

McDonald: "That's really cool and exciting. And I know this year is so great because being the International Year of Glass, it's really helping people become more aware of these different types of glasses and different applications of these glasses. So, what have you personally been doing to get involved with the International Year of Glass celebrations that are going on?"

Hubert: "So, have been active in some societies, like the International Commission on Glass, The American Ceramic Society as well. And so, through that, I've been working on some activities like helping prepare some videos to support the application to the United Nations. Then, have been involved in the organization of the opening ceremony that happened in Geneva in February. And still a few activities for outreach and things like that.

I think, as you point out, this year is incredible from that aspect. Having a material that we all love and work on being that much under the spotlight. That's really great. And I know one of these Ceramic Tech Chats was actually dedicated to this with Kathleen Richardson and Manoj Choudhary, who been very strong drivers behind those activities.

So, you know, I'm a glass nerd through and through. And anytime somebody asked me like, 'Hey, would you be interested in talking more about glass or helping with this,' I have a tendency to say yes—and then figure out if I can actually fit it into my agenda later on. That's a different story. Then, so, yeah, just what I hope, though is that it doesn't stop on December 31 this year. That really whatever is built this year by everybody that is involved in and everybody that will get involved in throughout the remainder of the year, that it continues and carries on way further than 2022 because, you know, glass has been there for millions of years, and we celebrate the International Year of Glass in 2022, so it cannot be the end. Just a point in the history, in the future Age of Glass. So, I'm really looking forward to it. I hope I have other things that I'm involved in along the way, but there's a lot of things to do and a lot of need for a lot of people to be involved in promoting this material."

McDonald: “Well, I know with promoting the material, you’ve also had the opportunity to do some teaching opportunities such as glass short courses, at the community college. Were you invited to participate in those? How did you get involved in, I guess, the more teaching side to do outreach on glass?”

Hubert: “I’ve been very fortunate as well to have these kinds of opportunities at the local community college. So, you know, in Corning, New York, there is obviously a big glass company, so there’s a lot of need for people around, and we also have the opportunity, where you have a chance to have some schools and this community college around. So, it was a good match identified a few years ago by some of my colleagues, who say, ‘Hey, well, why don’t we have some glass classes over there? Because we actually hire some people from the community college, so there’s a good interest in having people already know about glass before they come into our entire pipeline. So, in part of the standard pipeline building, there’s been these occasions to develop a glass course for this community college.

I’ve been involved in outreach and education activities prior to that. That’s a very strong personal interest of mine, to talk about glass and teach about glass. But also my favorite part is meeting new people and also hearing questions from the people you are talking to because there’s… Often my favorite question is the one that I am not able to answer because that means that I have something new I need to learn to be able to communicate around this. So, when those opportunities came to me and people around know I have this interest, I have been asked like, ‘Okay, are you willing to participate and help with those efforts?’ And of course, yeah, that was 100% yes, like, ‘Where do I sign and when do we get started?’”

McDonald: “When you’re teaching about glass or talking about glass, is there any particular question or concept that people find the most challenging to grasp or understand about glass?”

Hubert: “Maybe not necessarily the most challenging to grasp, but thing that may be more difficult to realize is how everything is interconnected from the raw materials that you choose to the final products and all the chain of events in between. That everything is strongly interconnected so to have a good product at the end, we need every single step to happen properly in the right composition to start with, of course, but if you have the right raw materials and coming with the right level of purities, and we need to mix them properly and take a lot of care there. Transport them properly to your furnace where a lot of things need to happen: the reactions, the melting, the fining, the temperature management. Then you have everything related to the forming process, having the right temperature, viscosity, the right forming process, and then everything that can happen there, then annealing and post-processing, beyond that. And all the inspection that needs to happen.

So, you know, it’s very easy to take glass for granted because a lot of these products like a bottle or a window are around us everywhere so it’s very easy to think, ‘Oh yeah, that’s

very easy to make,' like, 'There's so much around that anyone can make that.' But it's this chain of events or this chain of different processes that need to happen and to happen properly, to be able to be carried out properly one after the other, and how, if something goes wrong, it impacts everything downstream. This is I think the thing that is the most eye opening to some of the people. It's not disconnected events. It's a whole series that needs to be happening properly to make a product. And yes, we're fortunate that we have had a lot of amazing people working on this process for decades and decades and decades, so we know how to make it happen properly for a lot of products. But it doesn't come without its share of challenges, and there's still a lot of things to do there. And that's some of the thing that I would say it may not be a challenge for the people I'm teaching to, but maybe more a challenge for the teacher themselves and trying to convey the message that yes, glass is there, there's a lot of great very technical glasses, there are some glasses that are made it much more, much larger quantities. But there's a lot of challenges everywhere and everything needs to happen properly, and we need a lot of people with a lot of different backgrounds and a lot of different views and input in the process to make it successful. It's not a one-man process that somebody comes in and he or she can say, 'Oh yeah, I'm going to make you a great glass,' and figure everything out by themselves. In some of my talks I use the reference like it takes a village to raise a child. Same thing for glass. It takes a lot of people with a lot of backgrounds and a lot of experience to make a good glass."

McDonald: "Well, I know during the past few years during the middle of the pandemic, a lot of people have become more aware of how interconnected our global society is with the supply chain shortages, and the same thing kind of applies to get your raw materials for the glass, to even be able to get people who have the expertise to where they need to be so that it can be conveyed to others."

Hubert: "Absolutely. I'm glad you bring that example because a lot of people have been more interconnected, and what made that possible was the glass fiber that actually allows to transport the data. So, I don't know if everybody realizes that, but also that's one of the things that this, the kind of virtual or more online world that has stemmed from the pandemic is also very much dependent on glass and, like the billions of kilometers of glass fibers of optical communications fibers that there is around the world, so that's also one of the challenges, right? It's like the window is there, but people don't necessarily notice it. Fiber is a great example there. Like the world as we know it, with all the transportation of information and storage, I don't think it would exist without glass and without the optical fibers. So, it's another example there of the greatness of glass, but one of its challenges is it's there but it's sometimes unseen and people don't realize how important it is around this."

McDonald: But people definitely have been appreciating it now with being able to connect via Zoom, Google Meet, all the other digital platforms."

Hubert: "Absolutely."

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BREAK

McDonald: "From medicine to communication to energy, glass serves in a wide range of applications. ACerS's 'What are ceramics?' webpage provides a look at all the roles that ceramics and glass play in our world. It also offers free access to the *Bulletin's* annual December issue articles that take an in-depth look at the ceramic and glass materials used in everyday areas of your life. Check out the 'What are ceramics?' webpage at ceramics.org/whatareceramics."

SECTION 3

McDonald: "So where along the journey did you come to know about The American Ceramic Society?"

Hubert: "So the first time I was involved in any event of the Glass & Optical Materials Division, or the GOMD, for The American Ceramic Society was towards the end of my Ph.D., when I participated in a conference. That was a 2011 GOMD. That was actually my first conference as well. So, that's how I got started to know a bit more about The American Ceramic Society and the GOMD. And then, just from there, I liked the atmosphere of the conference, I liked the networking part of it, trying to meet new people. And so, that's when really when I started to have The American Ceramic Society and GOMD on my radar.

I know also like after graduation, I don't know if this is still the case, but I know you could have like a discount membership or a free membership for a year at ACerS just after graduating. So I took advantage of that, and so started to continue going to conferences, and when I saw a topic on the work I was mostly working on, which at that point was after my studies was more like glass industry, glass melting topics. I was going more toward those sessions. And I've been asked at some point like, 'Hey, would you be interested in helping the organization of those sessions," which I accepted to do. So, trying to get more involved in organizing sessions in those conferences, which later on led to organizing of symposium at these conferences as well. So trying to stay engaged and stay connected with the community. So I see there's a great networking part, there's also a great way to stay up-to-date with what's going on in the world as well. You know, it's easy to have the blinders on and being focused on your own research or your own area, but there's so much to gain by learning what others do in your field and other activities as well. So, for me, this aspect is really great. So that's why I really like to be connected into The American Ceramic Society and continue being involved into that.

And then, later on, I think two or three years ago, I started to learn more about the Young Professionals Network, and also the mentoring programs that The American Ceramic Society has. My first reaction was, 'Oh shoot, I wish I knew that when I was a student because I wish I could actually have participated in this as a student.' So I came to be familiar with those a little bit later on. But I say, there's some parts of a pool of students or young professionals that are out there seeking help or wanting to discuss about topics for

their own careers or their own interests and looking for partners to discuss that with or bounce off ideas or get some guidance or whatever help they can get. So, I liked that aspect as well, so I also volunteered in being one of the mentors. And I've been engaging that for three years now. I'm with my third mentee this year. I really like it because, again, I had a lot of people who helped me and guided me throughout my career. Not necessarily as part of a framework, like the ACerS PCSA and the Young Professionals Network, but still had those opportunities. So I feel that if I can help and also provide those opportunities to others, I'm very gladly doing that. And, again, I think I'll learn as much in these experiences as those mentees learn from me because all the questions, all the things they're going through, all the questions they may have also kind of force me to put myself in a different perspective. I can offer guidance on some; I can also try to research some topics they really want to talk about as well. So, I think it's a very fulfilling journey for me as well. I certainly hope for the mentees as well. I'm still talking to them, so I guess it's the case.

So, all these activities at ACerS, the GOMD, and all the ACerS groups provide I think are wonderful. And so, I'm lucky I found them at some point, and I'm still a member 12 years after because I find a lot of value in doing that."

McDonald: "Well, and that's one of the things that's so great about ACerS, is ceramics and glass is a niche field in some ways, and so being able to have this community, and especially the mentoring program where you can connect with younger students who probably this is their first time knowing glasses can be used in in biomedical applications, they can be used in communications.

With your mentees, I know you mentioned that sometimes they'll bring up questions that will cause you to go out and explore things you might not have known before. Is there any examples of those situations that were surprising to you or that you were really interested when you start looking into them?"

Hubert: "You know, it's a lot of the questions of the work-life balance, so what do you expect after graduating, or maybe some challenges you would see with being able to participate to conference, or I think maybe challenges like that. But some of the mentees continues like, 'Hey, I don't know how to go up to people and, you know, going to a conference and actually create my network.' Which I understand, but also what's always kind of strike me is that it's their question, but at the end of day they registered for program that is meant to do that and say, 'Hey, but you see, you have that in you because you already took the step by yourself to get there, so you're just a matter of applying the same thing just with a different group.' And these are the kind of things that I never really thought about before actually being engaged into these but also showing that.

I know networking is not necessarily always an easy exercise, but you've already shown the step that you have what it takes to get there, because by yourself you went out there and put yourself in a situation where you say, 'Hey, ACerS, please put me in contact with somebody I don't know because I want to learn from them.' And so, typically, how do you say that the glass community is, in the grand scheme of things, fairly small, but it's a fairly

close-knit community. There's a lot of, I have a lot of very good colleagues and friends in the community. A lot of people I never worked with or that are working on topics that I've never even remotely worked on, but hey, whenever we meet each other or whenever we need each other, it's always one email away, one phone call away, or just one question away at a conference. So being able to convey those messages and reveal that, it's something that I think is one of the main values of these programs."

McDonald: "And sometimes just having that confirmation from someone who's ahead of you in their career saying, 'You're doing all the right things now,' can be very reassuring because it can kind of feel like such a big wide world when you're just by yourself."

Hubert: "Yeah. And it's easy to be intimidated by these professors who have hundreds of publications and very accomplished career. But, you know, a lot of people are extremely friendly and there's just, the only barrier between you and being able to talk to them is just because maybe you're… The first step is not made, but it's just a matter of making it."

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CONCLUSION

McDonald: "As we celebrate the rich history of glass this year, let us also remember to celebrate its promising future as we continue advancing the Age of Glass."

I'm Lisa McDonald, and this is Ceramic Tech Chat."

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"Visit our website at ceramics.org for this episode's show notes and to learn more about Mathieu Hubert and ACerS PCSA mentoring program. Ceramic Tech Chat is produced by Lisa McDonald and copyrighted by The American Ceramic Society.

Until next time, I'm Lisa McDonald, and thank you for joining us."