CERAMIC TECH CHAT

Episode 10

Title – "Why science communication matters: Taylor Sparks and Andrew Falkowski (E10)"

INTRO

De Guire: "I'm Eileen De Guire, and this is Ceramic Tech Chat.

> For scientists, conferences often serve as the linchpin of their professional network. It is a place for them to share their research, find colleagues for collaborations, and gain ideas for future areas to explore. However, scientists do not always consider how to facilitate these goals when preparing for a conference."

Sparks: "It blows me away when I talk to my peers and I ask them, when they're going to a conference, I'm like, 'What do you hope to achieve?' And it looks like they've never even heard the question, like, 'What do you mean? I hope to give my talk.' It's like, 'Well, what do you hope to achieve with that talk? Are you trying to make people think, Oh, Eileen does amazing research, I should partner with her. Or like, Hey, I should look up her previous papers, or Hey, I should also work in this area. Like, what's your goal?' And it's like they've never even given it any thought.

So, I think thinking about your audience and what you want to achieve with the interaction with your audience, just if you do that alone, you will be a massively better communicator, because I don't think people do it. Instead, they think, 'This is what I've seen before, so I'm gonna do something that looks like what I've seen before.' And that's it. They don't give it any other thought."

De Guire: "That's Taylor Sparks, associate professor and associate chair of the materials science and engineering department and associate director of the Materials Characterization Lab at the University of Utah, which is affectionately known as the U. Sparks and Andrew Falkowski, a BS/MS student at the U, started a podcast called Materialism in January 2019 to bring the field of materials science to a broader audience.

What does it take to produce a science podcast? (Of course, we wanted to know.) And how has hosting a podcast changed the way they think about science communication in more traditional settings, like conferences?"

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SECTION 1

De Guire: "Before finding out how Taylor and Andrew decided to start a materials science podcast, let's first talk about how they each discovered the field of materials science."

Sparks: “So I knew that I liked tech and science. I really couldn’t pick, though. I didn’t know if I wanted to go the medical route, biomedical, or if I wanted to go mechanical engineering. And I was feeling this great anxiety about having to pick just one for the fear that I would be boxed into it. So I did a year at a school called Westminster in Salt Lake City, and it was mostly for rich kids, I think. And after a year of that, I decided that was not worth my time. So I switched to the U, and at that point I had to pick a major. So when I was talking to advisors, I just went to all the engineering advisors and the last one on the list was materials science, which I’d never heard of. And when she explained to me, ‘Hey, this is the junction of physics and mechanical and chemistry all together,’ man, it was just a no brainer from that point on. So, that’s how I fell in love with it and have never looked back.”

De Guire: “How about you, Andrew? You’re closer to the decision.”

Falkowski: “Yeah, my story’s a little bit different. So during high school, I was really interested in economics, but I knew that economics wasn’t the best path to take from like a financial standpoint. I was really interested in 3D printing and how it was going to completely revolutionize supply and demand and how we handle that. You know, I figured I need to have some sort of technical understanding of it. So I kind of looked at it and materials science was really kind of the limiting factor for 3D printing it, and still is, in many cases. We need better materials for that. So, initially I was gonna double major in economics and materials science. And then when I came in and met a number of the faculty within our department, I just completely fell in love with it and figured that if I like economics enough, I’ll learn it on the side. But I really want to dedicate my time to materials science.

De Guire: “That’s really an interesting zigzag.”

Andrew Falkowski: “Yeah, kind of a nonlinear way of getting here, but I’m glad I ended up where I did.”

De Guire: “Yeah, absolutely. So, Taylor, you’re a professor at the U, and so that means you also have a research program. Can you talk to us a little bit about your research? And, you know, what you’re looking at now, and kind of why it matters.”

Sparks: “Absolutely. So like most professors, I’m interested in a lot of things, and it’s hard to pick your favorite on any given day. But the thing that our group is known for is materials informatics. So this is, as you’re probably aware, in the last 10 years become a really interesting and emerging field of research. Which is essentially taking the tools that we’ve learned from data science and applying them to materials research problems. So, we’re very interested in that, both in using existing tools and developing new tools, and we’re interested in applying those primarily to energy materials. So we’ve looked at them for discovering new super hard materials, for understanding how you can predict the properties of high entropy alloys for nuclear cladding, for thermoelectrics, for refractory alloys, and on and on, but mostly in the energy space.”

De Guire: “Okay. And so you mentioned data science and informatics, which, as you mentioned, is an emerging field. So how would you say data science and informatics are changing the way you research and hunt for new materials?”

Sparks: “Yeah, it’s a total game changer. The primary thing is speed. The big trade-off is you’re exchanging accuracy for speed. ‘Cause we have really good ways of making accurate calculations of materials properties. Not always, but in many cases, we have pretty good code. So whether it’s something like DFT [density functional theory] or molecular dynamics, there’s lots of tools out there that can accurately calculate a property. The idea behind data science is, let’s throw out the precision and the accuracy, and instead go for speed with predictions. So it’s not a calculation, it’s a prediction of properties. And this allows you to do it at just insanely faster speeds. By some estimates, some people publish that it’s a million times faster, the evaluation speed of these things. And what that allows you to do is you don’t have to just contain your study to some smaller number of candidates and then calculate those. You can predict everything, and then you can follow it up with whatever you want, be that DFT and molecular dynamics or experiments or whatever you want. It really changes the way that we can think about materials sort of screening because we can access enormous volume of materials.”

De Guire: “Andrew, what are you doing in the lab with Taylor? Can you talk to us a little bit about the project you’re working on?”

Falkowski: “I’m involved in materials informatics, trying to develop new architectures for machine learning to try to predict new materials. The struggle with bringing data science to materials science is that, unlike where data science really flourishes in like big data applications, our data is very ugly and quite sparse. And so we have to think about new and creative approaches to informatics and other data science structures in order to actually get relevant predictions for materials science. And so trying to develop new methods and new ways of thinking about it, that’s sort of where my research stems around. And then I’m also involved in some wastewater research as well, which is loads of fun.”

De Guire: “I can imagine.”

Sparks: “It smells delightful.”

De Guire: “Gotta work on a sensor or some sort of surface to mitigate that. The other thing about materials science data is that each data point is pretty expensive.”

Falkowski: “Yes.”

De Guire: “One of the reasons.”

Sparks: “It’s interesting. We will go to these seminars with the data scientists here at the University of Utah, they have colloquium. And they talk about data, and they have to reduce it, right? They’re taking posts off social media and it’s in the billions, and so they

have to pare it down. And we have the complete opposite problem, where at best case scenario, you might have maybe 100,000 data points and that's like best, but the normal is a few hundred data points. And going and getting more is, yeah, like you said, very expensive, time consuming. So, it's very challenging.

I'd say another challenge is not just the data itself, but the task is different. If you look at the computer scientist, what they're usually, in many cases, interested in doing with their off-the-shelf data science tools is identifying average responses. Your average user buys these things and then wants to buy this thing, right? That sort of behavior. But that's not what we want in materials science. We want to learn from average and then identify extremes—the best, the highest, the lowest—and so it's a very different task as well."

De Guire: "Interesting."

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SECTION 2

De Guire: "So one of the reasons we have the two of you together on this podcast is because you have partnered on your own podcast called Materialism. What inspired you guys to start Materialism?"

Sparks: "I'm going to say that Andrew's the one that finally kicked my butt to doing it. So, Andrew, why don't you start off."

Falkowski: "Yeah, absolutely. When I first came as a freshman, I think a lot of majors really throw their early classmen, their underclassmen, kind of just like right off the cliff into the deep end of their major. Whereas MSE [materials science and engineering], we don't want to lose too many people because we already have, we already are so few. So I think we tend to like, try to wean them on to it a little bit. So we don't have very intensive courses. But I wanted to learn a lot more about my field. But when I was a freshman, I didn't have the knowledge to tackle academic journals. I'd read it, and I'd have more questions than answers by the time I was going through it. And so I was wondering if there was a podcast available that would help me casually learn more materials science concepts. I was a little bit dismayed that none of the ones at the time were ongoing, and going back and trying to listen to them, the audio quality was usually just awful. And it was just interviews, which were just as technical as the journal articles themselves. And so I wanted some sort of platform where I could learn more about materials sciences and share my passion for the field with the community.

And I heard just through word of mouth that Taylor was interested at one point in starting a podcast. So, I kind of just approached him when I was taking his class and pitched the idea, and we just planned a date, started recording. It was awful. We ended up re-recording the episode. But it's been going pretty steady ever since then. But, I mean, I still have the same problem. I don't listen to my podcast because I record it. So I still don't have a podcast to listen to."

Sparks: “I think it’s funny. He says that he pitched the idea. What he really did, he’s like, ‘Hey, I booked the studio and we’re going to record this, so let’s just give it a shot.’ And I loved it. It’s so great, so props to Andrew for making it happen. And I shared his frustrations. I, too, I love podcasts. I love it. I listen to so many and I love to learn from them, and I was so bugged that there wasn’t one dedicated to materials science. Instead, you’d find snippets here and there on other ones. So we wanted to make one.

And I’d say the other big influencer for me is eight years ago, I saw this guy speak called Jean-Luc Doumont. He’s this expert in scientific communication. He travels around the world to colleges and universities presenting. And I saw him speak once, and he talked about just the horrible way that scientists and communicators give their talks and what a joke it is. Like, you couldn’t design a worse way to convey information than the modern conference scenario. And how sad that is and how tragic compared to all the work that goes into the research. So his whole shtick was like, ‘You need to find a way to communicate that makes it stick, that really gets your point across.’ And I really buy into that. And so for the podcast, I too want it to be in a way that sticks and is interesting. And so that means bringing some enthusiasm and explaining it in simple terms and sort of changing the way that materials science podcasts have been done.”

De Guire: “That’s great. I think there’s definitely a need in our field. You guys were the leaders in this. We’re sort of taking a different view. We’re trying to communicate the excitement and the sense of discovery that comes with materials science. But then there’s, there are a couple others out there now too, so I think you guys are kind of showing the way. So, can we talk a little bit about what makes for a good communication of a scientific project or research and why it’s so important.”

Sparks: “Yeah, I’ll take a stab at this. I think the key thing that we’ve learned is, and this is backed by loads of evidence, is a narrative learning style. When you change it from just giving facts, ‘cause I could tell you about superconductors. I could start I could jump right into like BCS [Bardeen–Cooper–Schrieffer] theory and like explain what’s happening. But your brain engages with that information in a totally different way than if you show it as a narrative. So, you know, what that means is you put it in a story. Like you provide the context, right? We did an episode on artificial dialysis, so artificial organs. And when you tell the background that this was happening in Nazi, Germany, while it was the Nazis that invaded the Netherlands. And this guy was not a Nazi sympathizer, he was not a fan of them. And yet his first patient that he installed this artificial kidney on was a woman who was a Nazi sympathizer and how conflicted he must have been. And you talk about the tools he used was an old washing machine and orange juice cans and it was like sausage casing. That was the first artificial or, like, dialysis organ. So your mind engages with that information in a totally different way. And so it’s been really fun to structure our episodes wherever possible around that narrative, and also around explaining it in bite-sized bits. And this was Andrew’s idea. So why don’t you explain that, Andrew.”

Falkowski: “Sure. Just to clarify really quick. When you’re saying the bite-sized bits—”

Sparks: “I phrased that wrong. But like explaining it from basics. Like explaining fundamentals, as well as just what’s new.”

Falkowski: “Right. So, my approach to this was rather inspired by my experience as an undergrad. I could go on and I could get very basic understanding of chemistry from online resources and YouTube videos, but I couldn’t tackle the academic journals. There wasn’t really this sort of intermediate transition material out there. And so what we always try to go for is we start with the basics of an episode, and we just kind of build up and familiarize everyone with the concepts, and that allows us to then transition to the more complex material and allows them to follow it as well. So we’re not leaving behind people. Now the real challenge here is how do you, how do you walk that line between keeping it simple enough so that an undergraduate or a lay audience can understand it, but also interesting and technical enough that a technical background, a very experienced background listener would be able to enjoy it and be entertained by it. So it’s always a constant struggle of trying to find that balance, but I think we’re getting a lot better at it.

Going back to that narrative thing, one thing that kind of inspired me, and I haven’t put as much time into developing this as I would like to. But one of my favorite authors, I guess he’s more of a journalist, but his name is Tom Wolfe, and he’s really famous for starting something called new journalism, where he brought a lot of literary techniques to journalism to make it more exciting and narrative driven. I think that when you’re going into podcasting, I think that’s kind of the approach you want to take, right? You want to make it exciting, and if you skip some of the really technical details, I don’t think that’s a problem. I don’t think we should take podcasting and say we’re going to emulate journal articles. I don’t think it’s a good medium for that. You have to kind of think differently.

De Guire: “So it sounds like you kind of don’t differentiate really between how you approach a lay audience and a science and engineering audience. That the narrative idea works for even the highly trained science tech people.”

Sparks: “I’ll say I use it in my conference talks now. When I go and give a conference talk, I always if possible start with a narrative. Even if it’s your own narrative, like, ‘Hey, we for the last two years have tried to do this thing, and it didn’t work and how frustrating was it. And that’s why we decided to try x, y, z, which is what I’m gonna talk about today.’ How much more interesting is that then just saying, like, ‘I’m going to talk today about the effect of whatever in whatever.’ Like, that’s just so boring. But if you set the stage of the context, I think it really helps people.”

Falkowski: “Yeah, and think about retention as well. Like when you hear something that’s in a narrative form, you’re much more likely to retain it because there’s a logical sequence, and it kind of goes back to how we communicated knowledge for thousands of years in story format.”

De Guire: “Do either of you, or have either of you, ever struggled with stage fright or speaking anxiety?”

Sparks: “I’ll say I was. I was a really nervous, scared kid growing up. I’m Mormon, so I grew up in the Church of Jesus Christ Latter Day Saints, and part of that is serving an LDS mission. And so I served an LDS mission in Argentina, where for two years, 12 hours a day, from 9 a.m. to 9 p.m., you’re out beating the streets, talking to people, and man that’ll cure your fear of speaking with people really quick. Because you’re not only talking to people, you’re talking to them about Jesus in the middle of a country in a language that you didn’t know ahead of time. So, I think that that was by far the most important thing to help me get over stage fright. I came home a much more confident speaker.”

Falkowski: “Yeah, I still struggle with it, with in-person presentations. Like I’ve put a lot of time into practicing my presentation skills, and I think working on the podcast has helped me considerably. But I think it’s just becoming familiar with the topic and kind of internalizing it and also just being confident in what you’re presenting. I think a lot of times in classes, students don’t get enough opportunity. Like the presentations always like an afterthought, which ends up causing problems because students don’t put that passion that they probably need to become confident in the presentation, and the issues just kind of continue from there. But I think just practice is the best way to overcome it, and I think having these kind of Zoom online classes and new formats to talk to one another has almost kind of worked on that. You’re almost in a presentation mode when you’re talking with someone on this. You’re not going to act the same way as if you’re on a phone call or just chatting with them over text.”

(music)

SECTION 3

De Guire: “In terms of science communications, there’s a lot of new channels out there. You know, it used to be journals and conference talks, but now we’ve got podcasts, like you’re doing. Taylor, you have quite large YouTube footprint. You’ve given a TEDx Talk. Can you talk a little bit about some of these other channels and how they impact, especially how the public who benefit from science and engineering but aren’t really directly involved, how it benefits them.”

Sparks: “Sure. I’ll say it started with like the YouTube stuff. I started that because some students just asked me that they were going to miss class, I think it was, four years ago. And they said, ‘Hey, is there any chance you could record the lecture? Because I don’t want to miss it.’ And I was like, ‘Yeah, I can do that. I can screen capture it.’ And so I did. I just gave my regular in class lecture, but I hit record ahead of time. And it was, you know, I was surprised that when I did post it, more than just the three or four students that were going to be absent started listening to this. Like all sorts of random people on the internet started watching this, like full, random, ceramics class lectures. And they’re listening and watching and commenting, saying, ‘Oh, thank you for making this available, this is so great.’ And so I started thinking, like, if there’s an audience, why not keep on delivering this and changing the way I deliver it so it’s focused not only towards the people in the class, but also towards these online learners, whoever they may be. And what’s blown me away is just how many there are out there. The listener numbers are in the thousands per

day, and I'm just like a nobody professor making content. If you did this full time, I think there's a huge appetite for it, for people wanting to learn. I think it lowers the barrier. Like a lot of people, they don't have the resources to go to college, maybe, or they don't maybe have the interest in learning a whole semester's worth of content. But this one topic, you know, probabilistic failure analysis, I get tons of people learning about that. Maybe they don't want the full materials science, but they love Weibull analysis and figuring out how to probabilistically design for failure. I just think it makes it way more accessible."

De Guire: "Andrew, do you consume other science communications?"

Falkowski: "Yeah, I follow a number of battery researchers on Twitter, and I follow their research and some other updates. There's a number of YouTube channels that I subscribe to as well that are based on mathematics, engineering, and science. And I found initially I would watch them because I was trying to learn something for a class. But now, if I have, if like I'm eating dinner or something and there's nothing going on and I can't go outside, I will put one of these on and just kind of take it in and bring that knowledge into my own sort of repository. I've actually been reading a lot of like technical and science-oriented literature as well. I recently finished a book called 'The Art of Doing Science and Engineering' by Richard Hamming, and it was fantastic. I don't think a lot of engineers or scientists read enough, or at least read enough outside of academic journals and there's a lot of interesting perspectives that we could bring into our work if we look there. And I will say that looking at other forms of science communication has informed my thoughts about how we do the podcast as well. It's told me some things that we should bring in and some things that we should not.

De Guire: "What are some things you should not bring in?"

Falkowski: "I think we need to stay away from using highly visual descriptions, I guess. Like it's hard to explain what a diamond crystal structure looks like to your audience. It just becomes a waste of time. The time you'd have to spend to try to explain it, and then try to convert that to an auditory format and hope that your listener picks it up. It's just not worth it. I think that analogy ends up being the strongest factor. And you can also put things in the show notes. You can say like, 'Hey, if you want to see what this crystal structure looks like, here's a link to an image of it.' That's more powerful. And analogy is surprisingly helpful. I think the person who came across the carbon ring structure, he had a dream about snakes eating their own tails, and that's how he ended up being able to conceive of this ring structure. So I think using analogy to try to paint a picture in people's minds, regardless of how effective it ends up being, is a much better way to convey complex topics. You kind of have to pick and choose. You have to say like, 'Okay, this is too complex. We should touch on it, but not die on that hill of trying to explain it.'"

Sparks: "And we've done that on the podcast. We've definitely really tried to explain things, and it's just not the right medium. Focus on the strength of podcasts, which is storytelling."

De Guire: “And that brings you back to the analogy idea that you mentioned, Andrew, because analogy really is a way of setting a stage and presenting a story. You know, kind of reference a thing people know and say it’s like that.

What role has The American Ceramic Society played for you guys in your role as materials scientists but maybe also as communicators?”

Falkowski: “Well the biggest interaction we’ve had with them was having several people who were a part of ACerS come on to the podcast and share their knowledge, which was absolutely fascinating. It’s great to be able to interact with people who are experts in their fields and learn from them.

ACerS is a sponsor of our podcast, and being able to get additional resources from a much larger organization helps inspire us to do better with our products and gives us more access to experts in the field as well. And it’s just very encouraging to know that there are other educational platforms out there that are interested in furthering the cause of science education and getting people who are passionate into the ears, to put it that way, of people around the world.”

Sparks: “I’ll just say, American Ceramic Society has always felt like my home society. There’s lots of great professional societies for materials sciences, MRS, TMS, ACerS, there’s all these different ones. But ACerS has always had a special place for me. It’s where I published my first journal article. It feels like a community that I can interact with, like, I love going to their conferences. So I think for a lot of reasons, it has always felt like home.

So when we came time to thinking about potential people to partner with on the podcast, I already knew that I’d be covering topics related to ceramics, and so we said, ‘Why not partner with somebody like American Ceramic Society?’ Where, like Andrew said, we can get better people to interview, we can get resources, we can get cross pollination of ideas, like us being on your podcast and you being on ours, sort of thing. This all just improves us overall.”

De Guire: “Great.”

Sparks: “You know, it was crazy. When we wanted to do the episode on self-healing concrete, we started looking into it and then, did I find it or did you, Andrew? One of us, as we’re looking through articles, we found this great series of articles from this researcher, Marie Jackson. And then we’re like, ‘Oh my gosh, she’s here at Utah. She’s in the building next door. How do we not know this person?’ And it was so great. So yeah, I wonder who else is right around the corner, or virtually around the corner, that we could get in touch with that is the perfect person to talk to.”

De Guire: “Yeah, Maria is terrific. She’s written at least one Bulletin article for us. So, do you have any guests coming up that we should look forward to and get excited about?”

Sparks: “We have two episodes coming up that the Ceramic Society is really going to like, in the next two months, actually. One of them is on superconductors, and one is on ionic conductors. And these are both extremely important for a myriad of technologies, mostly in energy, but in other areas too.”

De Guire: “Okay. So what advice would you guys have for people who are interested in presenting their work to a broader audience in an effective way?”

Falkowski: “If your intent is to start a podcast surrounding your research and try to get it out there, you’re competing against so many people and against people who can pay money to advertise their podcasts, that your chances of actually getting out there and noticed are quite slim. I think the effort you put in might not be worth it if your goal is to just go out there and get attention or more people to see your research. I think that social media offers some great platforms, but I think you can look at existing platforms and try to partner with them. A lot of these, you know, big YouTube channels or podcasts are always looking for content. I think just emailing them—or us—you’ll find that they’re quite receptive and are happy to schedule an interview with you.”

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CONCLUSION

De Guire: “In today’s increasingly digital world, there are countless new platforms scientists can use to communicate their science outside of the traditional conference setting. Learning how to format your message to harness the strengths of each platform will not only help you to become a better communicator, it will help you to expand your sphere of influence as well.

I’m Eileen De Guire, 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 Taylor and Andrew and their podcast Materialism. Ceramic Tech Chat is produced by Lisa McDonald and copyrighted by The American Ceramic Society.

Until next time, I’m Eileen De Guire, and thank you for joining us.”