

## CERAMIC TECH CHAT

Episode 46

Title – “Lifelong learning in the changing education system: Carl Frahme”

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### INTRO

McDonald: “I’m Lisa McDonald, and this is Ceramic Tech Chat.

When preparing to learn about a new technology or research area, it is important to remember that learning is a building process that starts with a strong understanding of the fundamentals.”

Frahme: “There are a lot of things that go into ceramic manufacturing, ceramic R&D that are not just the ceramic technology, per se. When I teach, I really start out with basic technology, quantum mechanics and the atom and bonding and all that because if you don’t understand that, the basics, you can’t understand what else is happening, crystal structure and so forth.”

McDonald: “That’s Carl Frahme, a long-time consultant and educator in the ceramic, metals, and materials industries. Carl has played an integral role in The American Ceramic Society’s materials science and technology courses since his early industry years, and he continues to be an instructor for the courses currently offered through the ACerS Online Learning Center.

In today’s episode, Carl will share how he first became involved as an instructor for ACerS educational courses and how these courses have evolved over time.”

(music)

### SECTION 1

McDonald: “So, even though at this point in your life you’ve been doing ceramics and ceramics education for a very long time, how did you first get started in this field way back at the very beginning?”

Frahme: “It’s DNA. Everything is DNA. The reason I say that is my father was a ceramic engineer. And so I sort of got led down the garden path, you know, and got involved in it fairly early in my life.

I started out with a degree in metallurgical engineering. I was at Case Institute of Technology, which is now Case Western Reserve, and I took a ceramics course as one of my electives that they taught in the metallurgy department. So, I joined as a student member of the Society [ACerS], and that would have been 1961 or 1962.

My employment in the industry goes back to 1957. My father had started a cutting-edge ceramic technology manufacturing facility making high alumina ceramics and ceramic-to-metal seals. And so the summer between my junior and senior year in high school, I worked there, and after my senior year, I worked there in the summer. And so, that was my first employment in the ceramic industry. About a hundred years ago, it seems like.”

McDonald: “It really was destiny, then, that you would switch over to ceramic engineering.”

Frahme: “Yeah, that was sort of... You know, I followed my father’s footsteps, and I don’t regret that. I mean, there have been times I’ve wondered if it was the smartest thing I ever did, but it turns out it was. And I got, you know, I got exposed to it, and it was just in my blood, I guess, already. But once you get exposed to that technology, it sort of grabs a hold of you. It did me, anyway.”

McDonald: “So, what type of ceramics were you studying when you first went into ceramics research?”

Frahme: “Well, I got a degree from Rutgers, Ph.D. in ceramic science and technology. And I went to, my first job was with INTERPACE [International Pipe and Ceramics] in Southern California, Los Angeles area, in an R&D lab. And we didn’t do basic research. We were basically support for all the different divisions of INTERPACE. We got called into a lot of practical stuff. I did some product development, I guess is what you’d call it. I sort of had a practical bent to those things all my life. Not been, well, I shouldn’t say I have not been theoretical because I bring an awful lot of science into the courses I teach.”

McDonald: “So, how long were you doing your industrial career by the time you started maybe making your way toward ceramics education?”

Frahme: “Well, not very long, actually. I was with INTERPACE about three years, and I was active in the Southern California Section of The American Ceramic Society. The leadership of the Section in 1970, which was three years into my career in industry, realized that the people that were running the ceramic plants in the Southern California area—and there were quite a few of them in those days—didn’t know ceramic technology. I mean, most of the plants had a ceramic engineer someplace in their organization, but most of the people running the plants, you know, the supervisors and the plant foreman and managers and technicians, had no training in ceramic technology and no place to get it. And so, they were not doing a very good job.

And so that’s how I got into education. The Section decided to have a course or courses on ceramic technology at a local college, and I stuck my hand up and said, ‘I’ll do it.’ You know how you are when you’re young, like you are, you know, you volunteer for things like that. And I don’t regret it. So, I’ve had a lot of fun doing it.

We started our first course at Pasadena City College in 1971. That gives you a hint of my age. And I wasn’t young, well, I was young, but I wasn’t a baby then. And I did a

fundamentals course. And we arranged this through the Society with Pasadena City College. We started the course two days after a major earthquake in Southern California, and we didn't know what to expect as far as number of students who would come. We never really had a good idea anyway. We had a classroom for about 35 or 40 students at Pasadena City College. We got 70. We had to move to a bigger classroom. And so it was very successful. And it was a lot of fun to teach, I really enjoyed it."

McDonald: "So as you started getting into teaching, I know that there is quite a bit of a difference between knowing how to do the research yourself and knowing the information yourself, but then having to try to teach other people about that, transmit the information so other people understand it. What was, I guess, some of the challenges or fun things you learned when you first started going into this pathway of trying to help other people know about the research that you do and the materials you work with?"

Frahme: "Well, the advantage I had was that at INTERPACE, we were doing a lot of practical stuff. And when there were problems in the manufacturing facilities that they couldn't handle, and of course, they didn't have anybody to handle them really, the laboratory got involved. So, I got involved all over the country with the various divisions of the company. And so I had a lot of practical experience just doing that for the first, you know, actually, through all of my teaching.

And so the challenge was how do you get across these fundamental principles to people who are in the industry and working but don't have the basic science or the basic technology. And that was a bit of a challenge. And keep in mind that when we were doing this, we were doing things like using a carousel slide projector with color slides. We had just at our work gotten our first hand calculators. We didn't have personal computers. And so we didn't have the tools like we're using right this minute. You know, Dick Tracy had his wristwatch in the comics, but we didn't have any of that in those days. We do now. So, things have changed. But that was the challenge.

And being in a classroom. I still like live classroom teaching better than online. But online gives you such reach that you can't get in a classroom. You know, I've taught live courses with students all over the world tuned in just like you and I are. And that's mind boggling. It was something you couldn't conceive of in 1971. I mean, it wasn't a thought in our minds, and now we're doing it.

So that was the challenge. And I guess I had fun doing it, and I learned a lot in doing these first courses."

McDonald: "So after doing the first courses with the Southern California Section, I know that later on there was a Ceramic Correspondence Institute that got formed. So, how did, what was that transition and how did that happen?"

Frahme: "In 1971, I taught the first course, and one of my friends, also a Rutgers graduate, taught a second course on a manufacturing level. And then I taught the fundamentals the following year in winter and spring of 1972, but we didn't have as many students. And we

realized we were running out of students in the Los Angeles area. So we had this brainstorm, ‘Well, why don’t we do this by correspondence?’ And so four of us got together, our four co-founders of Ceramic Correspondence Institute, CCI, and we bought a used IBM electric typewriter—now, we didn’t have word processors and all that—and wrote up the courses longhand.

We started off with four courses, each one of us did a course, writing up longhand, hired a gal to type them onto paper, put drawings pasted—literally—drawings onto gaps in the text, and went to a quick print shop and printed up the courses and put them in a three-ring binder—we had a really fancy binder with our logo on it—and mailed them U.S. mail. And that started in June of 1972. So, that’s 52 years ago. You know, it’s been a long time. But that’s the technology we had, by mail.

And we did that for 15 years, all by mail. There wasn’t anything else to do. And by 1987, we had enrolled overall 2,700 students in 40 countries. Just blew our minds. We just never expected that. Now, that’s a lot of students in a lot of countries. The need was there, okay? There was no question the need for...and we were doing practical ceramic technology education. We ended up with 10 courses, and it just took off.

And we had a diploma program. We had to be authorized in the state of California because of the requirements of their Department of Education. And they required a diploma program. We hadn’t even thought of that. And that was the best thing that ever happened to us. I’m not much on bureaucrats, but those bureaucrats really made us a lot of money.

But we were all working full time in the industry. And so, you know, we were getting, you know, 300 students a year and had to handle all that by mail. You know, they sent in homework, and it was not a nightmare, but it was getting kind of over our heads. So we sold CCI to The American Ceramic Society in 1987, and they carried on from there. We still stayed involved as instructors and graders and so forth.

But the need was there then. It’s still here. It hasn’t changed a bit. It’s a worldwide need, as we found out.”

McDonald: “After selling CCI, is that when you launched your consulting service?”

Frahme: “Well, it was the same year, and it wasn’t for the same reason. I had been with a company called Industrial Insulations. I was one of their executives, and they had a fledgling refractory fiber business, and I took that on and built it up much bigger. In 1987, that part of the company got bought out by a larger external company, and we parted ways. So, I started consulting. And a lot of my consulting assignments ended up in employment. So, you know, I started consulting for somebody, and then I get employed by them. And then when that falls through eventually, I go back to consulting. And of course I kept on teaching as well.”

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## SECTION 2

McDonald: “So, you’ve talked quite a bit about how you’ve been teaching some of these different courses and these different topics. And for our listeners, that’s within the context of ACerS Online Learning Center right now, which has about two dozen courses where people can go online and they can engage with you and other instructors to learn about some of these basics and more advanced applications of ceramics. But all of this, you know, is available now because we have infrastructure like Zoom, but let’s go back to how did, what was the journey to creating today’s Online Learning Center?”

Frahme: “Well, when we sold CCI to The American Ceramic Society, we had a noncompete clause, okay? And we stayed involved with The American Ceramic Society. It’s a great Society, has been a tremendous resource, and a real support when we were running CCI. They sent every one of our students the *Bulletin* and so forth.

But in the 1990s, the Society was not doing anything with the courses as far as converting them to online, which was becoming available. At some point my noncompete clause, like 1997, I think, expired, so I decided, ‘Well, they’re not doing it, so I will.’ So by 2000, I had put together, I think it was a materials science course or ceramics, and I put it online. It wasn’t live broadcast, we didn’t have that yet. But we did have the ability to do something equivalent to like a PowerPoint or a thing like that. You know, it was still, you still had to read the text onscreen and they had a printed copy.

And so I did a course, and I went to the...CCI always had a booth at The American Ceramic Society Annual Meeting. So, I went and got a small booth at the meeting, I think it was 2000, to promote my online course, and I was working on some other courses as well. So, I went over to Greg Geiger at the booth, and he was publications guy then, and I said, ‘You know, Greg,’ I introduced myself and I said, ‘You know, here’s what I’m doing.’ He said, ‘Yeah, I’m aware of that.’ And I said, ‘You know, the Society hasn’t done this. Why?’ And he said, ‘Well, we just didn’t have anybody.’ I said, ‘You know, maybe we ought to join forces and do this together. You’ve got the marketing, I can do the courses. You know, I can redo the courses you have,’ because they still had the courses under their wing on paper, and I said, ‘I can put them online.’ And so we did that.

I did the courses, and the Society promoted that. And I was available by email on those days, of course, to answer questions, and I got the homework by email, so it didn’t have to come through the mail. So, I was able to help Greg put this together. We were really partners, and we still are. We have a great relationship.

In 2003 or 2004, the Society was having some financial problems, and they gave the copyright to ASM International. And so then I was teaching for ASM International. I did classroom courses with the fundamentals course and the refractory course in the early, I mean like 2006 and 2007, quite a bit at their headquarters in Ohio. So, the Society was advertising on their website, but they weren’t directly involved.

And then, gosh, it must have been that way, and ASM wasn't putting it into this format, you know? It was sort of still a static format, and so we eventually started doing this format in 2021 or 2020, something like that. We talked about it for quite a while, and then we started doing a different set of courses that I did to start things off. And then the Society has added a whole bunch of other courses done by other people, which is good because it gives you different perspectives. But the whole group of courses that the Society has put together is fantastic.

And the certificate program is sort of like what we had in CCI. And it's an important way for students who are trying to get ahead in their company to not only learn technology but to also have something to hang on the wall that says, 'Hey, look what I've done,' and put that in their resume for part of their job performance. So, it's another side of why this is so important. It's recognition for those people who put out effort to learn through the Society."

McDonald: "Can you explain a little bit about how the certificate program within the Online Learning Center works?"

Frahme: "It's quite flexible, actually. But there are several certificate programs, and you take a base list of courses, and there's room for a lot of flexibility there in the various technological areas, and get a certificate specific to the kind of industry you're in. You know, it's just a way of not only promoting getting more education, because one course isn't going to do it. I mean, it's a start. But you got to really dig down into your area of manufacturing or research or whatever it is and take several courses.

And that's one of the advantages. You've got specific courses for specific areas. You know, I've got a phase diagram course, for example. Well, that's sort of useful in a lot of different areas of technology. And there's courses on refractories, and there's courses on drying and firing and, you know, we can dig in more deeply than the fundamentals course. So, it's a huge asset for the ceramic industry and the materials industry.

And one of the other things that I think companies don't seem to do as much as they had before is get a group of your employees together to take courses if they're interested. And if you get enough students, we can even do those live as a focus group, sort of, where you can really delve into technology without fear of somebody else in the classroom being in a competitive company. And you can really then keep your employees sort of engaged and in step in the learning process. So, companies need to get involved as well in this with their employees."

McDonald: "And especially in today's supply chain climate. You know, even since the COVID-19 pandemic, some extreme weather situations, the different geopolitical conflicts going on, there's been a lot more about domestic manufacturing. A lot more countries and governments have been looking at being able to build these supplies, offer these supplies, do it within their own borders. And we'll need more domestic and local talent who specialize in these different types of topics."

Frahme: “I think there is now a swing back toward manufacturing in the USA. When I was in Southern California in the early days of my career, we had a lot of ceramic manufacturing in Southern California. Not very much now. Not the basics, anyway. And I’m doing a consulting project right now, have been for a year and a half about half time, which is not bad for an old guy like me, and it will go on for another year and a half to build a ceramic plant in this country. So, there is this interest because of supply chain and all kinds of geopolitical problems that we may have to do this. And it’s not easy because, you know, the cost factor is quite different. But, yeah, there’s some real advantages to it. But you got to have people.”

McDonald: “Yes.”

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BREAK

McDonald: “In addition to the Online Learning Center, The American Ceramic Society offers a variety of technical resources on its website, from ACerS four journals and the Bulletin magazine to the ACerS-NIST phase equilibria diagrams database and ACerS-Wiley books. Explore this wealth of resources by visiting [www.ceramics.org/publications-resources](http://www.ceramics.org/publications-resources).”

SECTION 3

Frahme: “I’ve had a long career. Obviously. Anybody can look at me and say, ‘Well, he’s not young.’ But I’ve had to reinvent myself many, many times. When I went through undergraduate and graduate school, the tools we had were a slide rule and paper and pencil. We didn’t have calculators, we didn’t have computers; that’s what we had.

And when I would teach—I taught at the University of Kansas for 10 years—and I would bring my slide rule to the first class and I said, ‘Do you know what that is?’ And I’d get these blank stares. Once in a while there’d be someone who’d say, ‘Yeah, my dad has one of those.’ He’d go, ‘They’re engineers,’ you know, they had an engineering dad. But that’s the tools we had. And now, you know we got Excel spreadsheets and word processors and PowerPoint, which is what I use for teaching live. These are all brand-new tools.

So, I’ve had to learn computer technology, obviously, because we didn’t have it when I was young. I’ve had to learn all kinds of new areas of technology that didn’t exist. If you don’t keep up, as an instructor or as somebody in the industry, you’re dead in the water. You can’t allow that to happen. So, we all have to keep on learning. And I’m still doing that. There’s a lot that I don’t know. I mean, you can’t know everything about even this field of ceramic technology, which is immensely complex and broad. So you got to keep learning. That’s one piece of advice that I can give to young people, that’s it.”

McDonald: “And I think that really is key, like as you’ve been saying, is that the best instructor remains a student themselves.”

Frahme: “On that. That’s well put, and it’s absolutely true.”

McDonald: “So in all of your time getting to teach, you know, on these different formats, in person, online, via email and even U.S. snail mail, what is some of your funniest or most serendipitous experiences that you’ve had?”

Frahme: “I guess the one that always comes to mind to me is early on at Pasadena City College when we taught that first course, there were four guys that came into class, drove about 70 miles. We started talking about slip casting of ceramics, which is, of course, what they do with sanitaryware, and they were working in a sanitaryware plant. And so, shortly thereafter they brought me a toilet sawed in half, so you could see the insides.

If you’ve never looked at the inside of a toilet, go online and look at toilet structure, and it’s very complex, it’s very difficult to cast these things. They’ve been doing it for a long time, but it’s not simple. And these guys who work in the casting shops have to be apprentices for several years before they can do it right.

And so they brought me this half a toilet and gave it to me, and I took it home. My wife did not particularly appreciate having a half toilet sitting around in my office. But I kept it for decades. When people would see this toilet, I just say, ‘Well, it’s for my half-assed friends.’ So, I had a lot of fun. Then finally we moved from California to New Mexico, I had to get rid of it; I was told I had to part with it. I still regret that. I loved my half a toilet, I really did.”

McDonald: “It’s just always so sad when dreams get flushed away like that.”

Frahme: “That’s right, it is, as I can tell you.”

McDonald: “So, what do you find the most fulfilling part of being an educator and being a teacher?”

Frahme: “I’ve had students all along the way say, ‘Dr. Frahme, you got me a promotion.’ And I say to them, ‘No, I did not get you a promotion. You got the promotion. I helped you maybe by having this education available to you, but you’re the one who learned and made a difference.’ But when you get that kind of feedback from students...

I used to do, at the end of my courses at the University of Kansas, I always had a lecture on ethics. Nothing to do with materials science at all. No, I taught a number of different materials science courses we put together. But I would do a lesson on ethics and sort of what we’re doing here: my background and what I’ve learned in my, because I was considered an old fart, you know, even 10 years ago. And so I...when a student would come up to me and say, ‘You know, I really appreciated that portion of the course. I really learned a lot from that.’ Nothing to do with materials or the course. And so when you can pass on knowledge and experience to younger people, that really means a lot to me.



And in my career, I've done a lot of consulting, I've had a lot of consulting assignments lead to employment. But you look back on that and you look at the contributions you can make, education to me has been the heart of my career, what I feel I've accomplished. I mean, I've done a lot of consulting, and I enjoyed it and I contributed, but to be able to help other people in this way has just been really important to me. Still is."

(music)

## CONCLUSION

McDonald: "Even as the tools and platforms for education have changed drastically in the past century, the need for programs to upskill employees remains as strong as ever. Through the efforts of dedicated educators such as Carl, we have and will continue to meet these needs through the current and future communication technologies and channels."

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

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"Visit our website at [ceramics.org](http://ceramics.org) for this episode's show notes and to learn more about Carl Frahme and the ACerS Online Learning Center. 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."