

## CERAMIC TECH CHAT

Episode 39

Title – “Innovation in materials supply: Michael Silver (E39)”

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### INTRO

De Guire: “I’m Eileen De Guire, and this is Ceramic Tech Chat.

Fusion energy, artificial intelligence, quantum computing—these and other futuristic-sounding technologies are quickly advancing toward the realm of reality thanks to today’s robust culture of innovation. But even the most advanced products start with raw materials. And we will see that innovation is no stranger to the raw materials industry and supply chain.”

Silver: “Innovation never lets you down. It’s such a great place to be, and you meet such amazing people. But you have the chance, and I’ve had many opportunities to say, ‘Do you realize we’re the first people in the world to see this?’ What an amazing thing.”

De Guire: “That’s Michael Silver, president and CEO of American Elements, a global manufacturer and distributor of advanced materials. Michael founded American Elements in the 1990s, before rare earths became the buzzword that they are today, and he has personally experienced the growth in importance that materials suppliers play in today’s global market.

We asked Michael about what comprises innovation at a materials supply company and how these companies handle some of the most challenging market factors affecting industries right now, such as geopolitical tensions and increasing calls for sustainability.”

(music)

### SECTION 1

De Guire: “Could you start off by telling us a little bit about your background, and how did you come to lead a materials company?”

Silver: “It was a road I hadn’t anticipated going down initially. I had started my educational program at USC [University of Southern California] undergrad and studied the sciences. My father’s a radiologist, and I was looking at possibly pursuing something in the healthcare field. And as I kind of evolved as a human, grew up, understood myself a little better, I realized I’m really a businessman. I enjoy the numbers. I enjoy macroeconomics. I enjoy innovation. And so I switched my graduate training, went and got an MBA and a law degree rather than going to medical school. And was sort of out searching for the

thing that would make the difference in the world that I, the better mouse trap that I could build.

And this was the mid-90s. I'd been practicing law for about 8 or 9 years and discovered through representing in the world I was in at that point, I was a corporate lawyer doing mostly merger and acquisition work, that there was a gap in the chemical and metals industry. Nobody was addressing what I thought would be a burgeoning need out somewhere soon in the future, it took a little longer than I thought, for high-technology materials. I was even giving speeches to people that are lawyers that someday when someone says, 'Were you in high technology?' it didn't mean you just wrote computer code. There was more that was going to be going on, and all these incredible materials we were just starting to hear about, applications with things like rare earths and the more interesting refractory materials like niobium were starting to become really important. And I thought I would build a company in that industry because I'd already worked with chemical mining companies as an attorney on the finance side that there was going to be this opportunity.

And in the mid-90s, I left the law and began to build the company. I built first company before American Elements, this is kind of give some of your viewers, this is how long ago this was, there was a burgeoning printed circuit board industry in the United States, which no longer exists. And I had acquired a technology, which basically was kind of what you're looking for if you're in this industry, particularly today with the need to reuse and recycle and do the sustainable methods for production, was recycling printed circuit board etchant. And what that meant was, it was a closed loop system where we produced etchant, sold it to the printed circuit board industry, which was one revenue stream. We took back the printed circuit board etchant, which was a hazardous waste, and that had a disposable fee tied to it, which was a second source of revenue. The primary contaminant was the pH level because of the acidity necessary to etch the boards, but what it also contained was a pound and a half of copper per gallon. So, we recovered the copper, produced several copper compounds, ceramics in essence. Copper oxide, which has numerous applications. Copper sulphate, which has a lot of applications in farming. And then returned the recovered etchant in the process to the printed circuit boards. So it was basically three income streams. It was a wonderful process. Did very well as a starting company.

But of course, the printed circuit board industry moved out of the United States. I don't know if there's any left. There were even several in California, if you can imagine that. So we have plants in California, Connecticut, and North Carolina. And I basically had to sort of roll that into other applications. And then I just started sort of adapting the recycling concept to producing other materials. And this is right when John Croat at Delco Remy, which we know as a division of General Motors, developed something called a neodymium iron boron magnet, which are now ubiquitous in our lives, from our ear pods to everything. But this was the beginning development. He actually wrote the patent, I believe it was in '88. So this is about 8 or 9 years later, and there was one or two Japanese companies, one or two American companies, obviously Delco Remy was very involved.

they spun off a division called Magnequench, which is now a Thai company. I won't go into that history; it went a lot of different places. And so, we wanted to be part of that, too.

That's when I first got involved in China, which was the mid-90s. Began sourcing neodymium from China. And we also developed a recycling program where we were producing the starting raw material to produce the magnets, which was not an oxide, it was a fluoride. Because you're doing these metallic melts and you don't want your, you know, furnace to explode basically from the oxygen popping and making noises. So, we were producing a fluoride. And it was a very, very, very good business at the time. All the scrap. If anyone's curious, 'Well, why aren't you still doing that?' We got better at making neodymium magnets, and this pile of scrap that was being created, I'm talking about massive tonnage a month from a number of different producers from all over the world were shipping to our North Carolina plant, that just dried up like anything else. You know, that's one of the lessons in the industry. You have to keep moving.

But in the process of that, we developed several other neodymium fluoride technologies using a number of different industries. We realized that innovation was as much a challenge to us as it was to the customers we were trying to serve, and we had to always think about the things we were producing. What's everything else we can do with this? Always looking at everything as an opportunity that's right around the corner that we're missing.

And of course, as I got more involved in rare earths in China, oftentimes American Elements is described as the company that opened up that market because China was at that point not really shipping anywhere. There was one company, French pharmaceutical company that had access to some of their materials. But the Chinese weren't yet involved in it really at all, except for to provide the materials to the French. And so we got involved directly with the Chinese government and began acting as an agent to ship their materials to Europe, Japan, and the United States through American Elements. And that, of course, is now many, many, many, many companies are involved in that. But we were involved in the late '90s when it was a very, very different place. It was wonderful to be part of China's opening up to the world, in many ways, and opening up to interacting and doing things in kind of a more globalized business manner. It was an exciting time for me.

So that really began the company. And I have very, very talented people in the company now, we've grown quite a bit. And we just basically are omnivorous and would look for opportunity wherever we could in materials science. We have plants around the United States. We have labs in Europe, production facilities for smaller quantities for pharmaceuticals. And everybody's looking for the next opportunity. You can't sit still, which is what I think my earlier lessons taught me. You know, practicing law, you can sit in your chair and assist the next customer. But in business, you always, always have to keep looking.

Maybe as my final point on this question, I'll quote Andrew Grove, who many of your listeners will know. He was one of the three guys that started Intel, and he wrote a book

about the experience, and the name of his book is ‘Only the Paranoid Survive.’ And I would leave that with any listener who chooses to be entrepreneurial. It’s accurate.”

De Guire: “Alright. So, it sounds like that resonated.”

Silver: “Yes, very much so.”

De Guire: “Well, it sounds like sustainability has been kind of one of the calling cards of your business from day one.”

Silver: “Very much so. And it’s an ongoing process. It’s also a lot of working with the customers. We try to get into the production line with a customer and try to avoid recycling really and try to find reuse methods. I mean, that’s really the best way is 100% consumption or coming up with a way where things are really still in a reuse within the same industry. The moment something goes to recycling, you’ve really lost a massive amount of value. So we try to find ways so that materials are consumed a 100% or are in a reuse state within the same industry.”

De Guire: “It’s really interesting to kind of understand a little bit how that relationship between a supplier and a customer works. And the back and forth that happens especially now that so many companies really have committed themselves in writing to sustainability goals, whether it’s driven by regulation or driven by investors or driven by their own supply chains. It’s really something that’s different now than, say, even 10 or 20 years ago, that sustainability is part of every conversation.”

Silver: “Sure. And a lot of the quality standards, like QS9000 and ISO, they’ve now more and more integrated sustainability and reuse, recovery, recycling within the programs. I think that’s fantastic.”

De Guire: “Absolutely.”

(music)

## SECTION 2

De Guire: “So, various critical elements often make headlines in *The Wall Street Journal*, *Forbes*, *The New York Times*, all the major outlets. For example, China announced some new restrictions on its exports of gallium and germanium. So, from your perspective, what are the critical supply chain issues, and what are the actions that are available?”

Silver: “It’s complex. The answer is not to just simply locate other sources for these materials. Plate tectonics decided where things are going to locate, and when governments stepped in and established national borders, people didn’t realize what they were doing was creating winners and losers. So, things are where they are.

To me, the only way to get this thing worked out is by multilateral or bilateral treaties. Use the strength of our markets, people want to sell their products into the United States. The strength of our soft powers, as a country people want to be associated with. And get countries to sign contracts, not so much that they're going to charge more or less for the material, but they won't charge a different price. As long as people aren't creating that differential, then the markets are going to take care of the rest of it. Whether it goes high, whether it goes low, it's not a big deal.

I'm not super concerned about, you know, global war. It's really about the battles and the dislocations in industry that can result when people start creating these independent economic zones for the key industries, certainly AI is one of them. Your viewers also may know the word siloing. That's now become a real buzzword in industry. But China and the United States, the two countries are siloing, and we're going to see more of, to me, a détente kind of approach to economics where, yes, there's going to be a lot of reaching across the regions, working with each other. But you have to develop your own independent supply chain within your universe.

So, we have a lot of geopolitical issues, but they're not going to stop the march of innovation."

De Guire: "As a materials supply company, what comprises innovation?"

Silver: "That's really an excellent question. I made a decision very early on that I would follow a system that was developed, I think, in the '70s. There were several really good articles on it, if your viewers are interested. It was called Chemistry 2020, and it was an initiative to get suppliers to think differently about how they address innovation of their customers. At least that's how we read it. And the idea is don't just try to build a better mouse trap and then a sales team, marketing team around it and tell the world you just built a better mouse trap. Kind of the way the pharmaceutical companies work. You know, they produce something and then they tell the world they need it. That was the way it was done in the chemistry and metallurgy fields, which eventually became high-tech materials with us. That's how you did it. You had your sort of almost isolated group of R&D people that were trying to develop something.

We instead use a 2020 approach where we just stay very, very close with our customers. We have salespeople who are really engineers disguised as salespeople in the operations watching what is happening and seeing what might be needed at any given point. So, we're involved in the purchasing, we're involved in the engineering side. And something may come up, and they say, 'Gee whiz! We're trying to close the gap on this particular parameter on the material.' It could be a piezoelectric, it could be all kinds of things. And then we step up, and then we say, 'Okay, fine. We have a defined research project. Let's get going on it.' And then our R&D program steps in and tries to develop something to assist with that issue.

And it works in a whole bunch of wonderful ways. If the work's proprietary, we sign NDAs, of course, all the time. Fine. But oftentimes it's not proprietary, and oftentimes it'll

involve multiple companies. We'll get involved in a little informal almost colloquium with a group of companies. Say, 'Gee whiz! We'd all be benefited by solving this problem.' And once the problem's solved, American Elements has a new material to market to the world. And that's happened many times.

So, that's the approach we've always taken. Is stay close to the customers, stay close to the industry, attend the wonderful conferences—that's a plug for you—and listen to what people are doing. Just talk to people, go to the meetings, go to the lectures, and just see what people are working on. And then talk to people after the presentations and say, 'Have you guys considered this or considered that?' And that's how innovation starts at our company most of the time. It starts with the customer."

De Guire: "Great. So, American Elements is a Corporate Partner of The American Ceramic Society, and a long-time supporter of our meetings and publications. The company supports many other professional societies, too. So, what's the benefit of your company to being connected in that way with our Society but maybe other societies in general? How do we bring value to a company like yours?"

Silver: "You know, if you don't get everybody together, science can't move forward. And I already actually somewhat answered the question that if we don't know what's going on in the minds of the scientists at our customers, we're going to fall behind. It takes time for us to develop needs, you know, meet needs, and the conferences are amazing. I would put yours at the top."

De Guire: "Thank you."

Silver: "They've always been fantastic. And I've been attending them for over 20 years. There are, as you said, others. In the metals, TMS has wonderful things in the metals industry. The American Chemical Society has wonderful meetings. In each of the groups, there's somebody bringing that type of value proposition.

And science dies when people aren't getting together. You can't produce well in a lab by yourself without interaction with people. So, you go to these meetings, and sometimes I'll just buzz around the various groups of people talking, with no idea what the subject matter is, just to listen in, see if I can add something. So, it's that getting together that's quite incredible."

De Guire: "I think the way I view it is we create a community. A community of people who are interested in a field of materials and applications. And it's a diverse community, but we bring them together for a conversation, maybe a drink, and who knows what will come out of that. And we've been doing it now for 125 years, so must be on to something."

Silver: "Yeah. I can think of a particular meeting with a particular customer in the oil industry. We just happened to get together, went out, had a wonderful time, and ended up developing two proprietary products that we co-marketed to the drilling and oil industry. But the gist of it was just a couple of people, it was four of us in total, one from my

company, myself, and two from the other, with no intention to do anything other than having a couple drinks and laughing. And really didn't think there was anything between what we were doing and what they were doing. They were just really nice people. And out came something that is still a very important product of our company, two products for our company. So, you get that kind of thing happening, where you're just surrounded by so many bright, interesting people that you don't know what's going to flow.

De Guire: "Right. And you have to have an open mind. You have to have an open mind and a creative mind to say, 'Hey, you know, your problem intersects with something I know something about, and maybe we can follow that train of thought for a moment and see what comes out of it.' And here you are.

Silver: "Right."

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BREAK

De Guire: "The American Ceramic Society Corporate Partnership program serves companies of all sizes that wish to grow their business and support their industry. Companies gain access to ACerS' global network of ceramics and glass professionals, our publishing and professional development resources, and the Career Center for recruiting talent. Learn more about the benefits of ACerS Corporate Partnership by visiting [www.ceramics.org/corporate](http://www.ceramics.org/corporate)."

SECTION 3

De Guire: "So I noticed on your website that American Elements also supports a number of arts and museum organizations. So, what in your view is the intersection between materials, business, arts, and culture?"

Silver: "It's a personal interest of mine. I've collected art most of my life. My parents were big art collectors, so I caught the bug. And I then just as a matter of just trying to be a good community person, getting involved, I joined the boards of a couple of museums and have made donations.

But on the separate side, there is a lot of science in museums, and in art, and in cultural institutions. And I've really gotten very involved in that in my own life. You see work being done on new analytical techniques for aging and dating and understanding materials as they're used.

I'll give you one, for me it was an incredibly exciting example, was we were involved with assisting on the analysis of a funerary mask at the Getty Center in Los Angeles. A number of these mummies and casket structures they put the mummies in were done for Romans because once you get to the Ptolemaic era, that was really the Greeks taking over Egypt, and then when Rome invaded, it became pretty much a Roman colony. And since it

was a more ancient culture, the Romans always look to the Egyptians for what was cool, and so you'd find Romans buried as Egyptians, and you'd find a lot of cross pollination between those two cultures, particularly at the beginning of the Empire, kind of sort of around 100 AD to 200 AD. They got really into Egyptian stuff.

And this was a funerary mask for a Roman woman who lived in Alexandria. She had this green necklace on, and they did an analytical study of what the materials were, the chemical basis for all the pigments used to create the mask. And discovered that the necklace, which was a green necklace, they used a material that was the same material that the Egyptian alchemists, which were really kind of the first alchemists, were using to dye quartz crystal into emeralds. And so accordingly, they could do this process, very secretive, and create emeralds. And so, they use the same alchemistic material as the pigment for the mask. And I just thought that was fascinating. You know, that kind of opens up something to you that, you know, that's 2,000 years old. And it was just an incredible experience we were involved with that study.

But more recently, and this is getting a little out of ceramics, it's more about intersection of anthropology and archaeology, is the work by David Reich at Harvard. If anybody's interested, I'll just give a few sentences on it. I suggest, looking up David Reich. There's a number of videos on YouTube, you can get a sense of what his work is. That he's been involved in doing DNA extracts from ancient humans and then using that similar to the way like Ancestry.com, you know, these various sites established who you're related to. Well, doing that with bones from roughly around 50,000, 60,000 years ago, forward to the beginning of the Bronze Age, around 8,000, 7,000 years ago. It's really years ago, not BC. Sort of around 5000 BC is when really the Bronze Age got going. But in the period before that, going back all the way to when humans first entered Europe. And now they're starting to do Asia, but Europe is where they started the study. You can determine the tribal migrations that basically establish the European population. And it's unbelievable how interesting and how different anybody expected it was.

So again, all this was done through science. It was done through genetics studies. It wasn't through locating pottery or something. It's basically now all tied to DNA. It's absolutely fascinating.

And, you know, what is probably the first ceramic to some degree is bone. So, you're basically doing ceramic analysis when you do these DNA studies."

De Guire: "That's a good point. Those are all calcium phosphates. So, with minerals, you know. And then you find out like what the diet was and all that stuff. Well, thank you for that tip.

Alright. So, we're getting close to the end here. So, if you could enter a time machine and give career advice to your 20-year-old self, what would it be?"

Silver: "The first words to come my head is don't give up. You know, believe in yourself. Come up with something that is the biggest thing you can think of. I've told this to a number of young people. Come up with the biggest thing, and this is someone who wants to be



entrepreneurial and wants to establish a business, don't go for something small. When I started the company, I said to myself as an analogy to friends of mine, so they'd understand what I was doing because everyone thought literally I was nuts to leave a very successful law practice to start this crazy business. My mom, she'd tell friends about what I'm doing, and she'd tell them that I'm somehow doing something with rare herbs. She didn't even understand what I was talking about, nobody did. Nowadays, everybody's asking, 'What stock should I buy? Because they're in rare earths.' But I mean it was just a nonexistent thing.

But the thing is, the way to look at it is, whatever the biggest thing is you can think of, the broadest, biggest business, it will be miniscule compared to the guy who may be sitting right next to. He's just got a bigger mind, a bigger cognitive map. So, do the biggest thing you can think of, and trust your instincts that it's going to work during hard times. Because I went through years where people just said what I was doing was crazy. No one's ever going to need this stuff. And being ahead of the curve and being a first mover was very valuable to the company, but I just believed very strongly.

There's also the phrase the Three Fs Rule. You only have so much time. And the Three Fs Rule, and I think it's a beautiful way to put it, is Fail Forward Fast. And that's how we develop a lot of technologies. Obviously, that's what the company is built on, is coming out with innovative materials. Not just supplying the catalog, which does very well, too, but basically what we create for others and what we create to market ourselves. We always begin with the phrase, you'll hear people say, 'Okay, we're going to start failing.' That's how you have to look at it. You can't look at it as if you're going to build this, have this idea, and it's going to work. It isn't going to work. It just is not going to work. So, you just fail forward fast. You build data, and you get there eventually. But you have to accept a series of failures in order to make the discoveries."

De Guire: "Absolutely."

(music)

## CONCLUSION

De Guire: "While witnessing the launch of next-generation advanced technologies is exciting, it is innovations on the materials level that made many of these developments possible. As such, it is important to acknowledge the role that materials supply companies like American Elements play in this process.

I'm Eileen De Guire, 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 Michael Silver and American Elements. 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.”