

## CERAMIC TECH CHAT

Episode 41

Title – “Designing capacitors of the future: Yoshiki Iwazaki (E41)”

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### INTRO

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

Hidden inside almost every electronic device today are multilayer ceramic capacitors, or MLCCs. Since the invention of these small electronic components in the 1960s, MLCCs have grown into a multibillion-dollar industry that continues to expand as demand for electronic devices increases in various sectors, for example, electric vehicles and renewable energy technologies.

One company that plays a significant role in the MLCC industry is Japanese materials and electronics company Taiyo Yuden. Taiyo Yuden not only manufactures MLCCs but develops next-generation, cutting-edge capacitor technologies thanks to dedicated staff that includes an ACerS member.”

Iwazaki: “So, the main target material for our lab is barium titanate, which is used in MLCCs. And we are doing various analyses, such as dielectric properties and insulation degradation and temperature characteristics, to improve the properties of MLCCs.”

De Guire: “That’s Yoshiki Iwazaki, senior principal scientist and general manager at Taiyo Yuden in Japan. Yoshiki became involved with electroceramics research after joining the company, and he now uses simulations based on first-principles calculations to study materials and processing of MLCCs.

In today’s episode, Yoshiki shares details about his work on electroceramics, including his different responsibilities after transitioning into a managerial role, and where he sees research at Taiyo Yuden headed in the future.”

(music)

### SECTION 1

De Guire: “So how did you settle on a career in the ceramics field?”

Iwazaki: “I got into ceramics after I joined Taiyo Yuden, my current company. I was doing research on the synthesis of a thin film material. My goal was to design a new material by using pulse laser deposition. And at that time, I strongly felt that it was very difficult to design new materials only by experiment because, at that time, I couldn’t find any direction on what to do or how to do it. And at the time, I learned that there is a

calculation method called first-principles calculation. And I felt like this is it, and I started to learn the necessary expertise in computational science. And this is how I became interested in computational science and ceramics as a subject.”

De Guire: “Fascinating. So, what area of ceramics do you work in?”

Iwazaki: “Okay, so, I mainly work in the field of atomistic and molecular simulations, such as first-principles calculations and classical molecular dynamics. And additionally, my research group is focusing on atomic-level analysis using techniques such as transmission electron microscopy.”

De Guire: “Okay. So, you use theoretical physics and first-principles modeling, which is interesting. How does basic science research help innovation and benefit a manufacturing company, such as Taiyo Yuden?”

Iwazaki: “So, we’re currently working on optimizing MLCC compositions on a computer using cutting-edge first-principles calculations. The effect of additives on barium titanate used in MLCCs is very important, as they determine the characteristics and reliability of MLCCs. So, the optimization is very important, yeah, necessary. And I believe that the optimization using computation science without relying on experiment is extremely important for speedy development in the manufacturing industry in the future.”

De Guire: “Okay. So, how is supervising and leading research different from being the research scientist doing the work?”

Iwazaki: “Good question. People who supervise research have more opportunities to have broader perspective than researchers. So, the most important role in leadership is to determine the direction of research. This on the broad perspective that includes society and related technical build and organization issues and etcetera.

And since the individual researcher topic must be left to the researcher, the supervisors are expected to proceed with the overall research based on good communication and relationship of trust with researchers. I think this is the job as a supervisor.”

De Guire: “Okay.”

Iwazaki: “In my company, especially the young generation, is interested in the computational science. And I am teaching them. There are so many young scientists in the company.”

De Guire: “That’s great.”

Iwazaki: “I feel a little sad because I don’t calculate much by myself these days due to my management job. But my coworkers are doing very nice job, so it’s okay.”

(music)

## SECTION 2

De Guire: “Taiyo Yuden has a strong tradition of driving innovation. For example, in the 1980s, the company helped Sony and Philips develop recordable compact disk technology. And Bluetooth and Blue-ray technologies have Taiyo Yuden products in their DNA.

So, the Japanese company Taiyo Yuden exited the media recording business in 2015 but still generates about \$2 billion in revenue annually in its global operations around the world. So, these days, what drives research in electroceramics at your company?”

Iwazaki: “Until now, our company, Taiyo Yuden, has been working on small and high-capacity capacitors, which are typically used in small electronic devices, such as smartphones. And currently, as automobiles become more electronic, demand for capacitors with highly reliable design is increasing. And I think that the automobile-related market will become an important market in the future.”

De Guire: “Okay. So, Taiyo Yuden is an innovating company. Are there examples of how your company helps your customers innovate their products?”

Iwazaki: “Okay, so, the miniaturization of electronic devices has been supported by very small and very high-capacity MLCCs. And we believe that our company’s products will continue to be useful in these product innovations.”

De Guire: “Taiyo Yuden’s website says that it aims to contribute to a sustainable future through the wonders of science. So, can you please talk about how Taiyo Yuden’s products help others meet their sustainability goals?”

Iwazaki: “So, by enabling our customers to create energy-efficient products using our very small and high-capacity capacitors, we can help our customers’ sustainability goals. And we also believe that by supporting the realization of better electronic vehicles with our electronic devices, we can contribute to reducing environmental impact from a global perspective.”

De Guire: “Okay. So, where do you see research heading in the future? And how will this research affect society?”

Iwazaki: “I think AI will be much more important in the future, and knowing how to use AI effectively is important. Even now, in the calculation of atoms and molecules, molecular dynamic simulations using machine learning potentials are already becoming possible. And that allows calculations to be made on a much larger scale and faster than before.

And I also think that the other important factor is generative AI. I’m interested in how the use of generative AI will change the way of research that previously required creativity.

And these changes are expected to impact how future research is carried out from a social perspective, and the skills required for researchers, their working style, and etcetera.”

De Guire: “Okay. So, switching gears just a little bit, what excites you about coming to work every day?”

Iwazaki: “It is very exciting to think how our research results will change the world of ceramics in the future, especially when we discover the mechanisms of previously unknown phenomena. So, our daily research, it is very interesting and exciting.”

De Guire: “Great.”

(music)

BREAK

De Guire: “The American Ceramic Society’s Electronics Division focuses on electronic materials and devices in both traditional interest areas as well as emerging research areas. This Division coorganizes the Electronic Materials and Applications meeting with the Basic Science Division each year. Learn more about this Division at [www.ceramics.org/electronicdivision](http://www.ceramics.org/electronicdivision).”

SECTION 3

De Guire: “So, you’re a member of The American Ceramic Society. How has being a member contributed to your career?”

Iwazaki: “The American Ceramic Society has a wide, worldwide network of people and has provided a very valuable meeting. And for me, it is a very nice communication platform to work with people from different countries.”

De Guire: “Do you remember when you joined? Were you a graduate student or already working?”

Iwazaki: “Already working.”

De Guire: “Okay, wonderful. Are there any funny stories that you might share from your time in the lab?”

Iwazaki: “Okay, so, this is not about the lab, but I was awarded the Fulrath Award of The American Ceramic Society in the past. The award ceremony was held in Salt Lake City, very nice city. And at the ceremony time, I actually overslept at the hotel and ended up being extremely late. So, I was very frustrated at that time, but now it’s one of the topics of funny conversation with the people involved.”

De Guire: “Yes. Well, your body probably was still thinking it was in Japan.”

Iwazaki: “Yes.”

(music)

## CONCLUSION

De Guire: “Basic science research is essential to realizing new technologies and devices. Companies such as Taiyo Yuden that can support this type of research in-house help accelerate the transition of these findings into commercial products.

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 Yoshiki Iwazaki and Taiyo Yuden. 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.”