

Speaker 1 00:00:05 Welcome to the Clear Impact Podcast brought to you by PGTI University. Thanks for joining us today. My name is Sherri Connor, and I am your host.

Speaker 1 00:00:20 Power-generating glass. And I think, if I remember correctly, that's called photovoltaic glass.

Speaker 2 00:00:26 Yep. Exactly.

Speaker 1 00:00:27 Look at me. I can say big words. <laugh> I don't know how to spell that, but I got it. I know how to say it. <laugh> so what is that?

Speaker 1 00:00:38 Wouldn't it be great to have a crystal ball so you can see into the future? Well, we don't have one, but we did get a peek into what the future of glass looks like. With glass being a huge component in our products, we're grateful for our innovators here. Today's episode brings back Dean Ruark and Kenny Vander Bent as they share – as much as they can - around Innovations with glass.

Speaker 1 00:00:59 We are here on the Clear Impact Podcast, and we are in the series Innovations, and today we are talking about the future upcoming technologies, and we have Dean Ruark and Kenny Vander Bent back in studio. Thanks guys for joining us today.

Speaker 2 00:01:11 Hey, glad to be here for sure.

Speaker 1 00:01:12 So glass is a major component in what we do and what we have works amazingly well, the impact products and insulated products that we offer. Um, but there are some new things coming, and so I really wanna give our listeners a little sneak peek into whatever we're allowed to talk about. <laugh> With upcoming technologies, um, around glass. And so there's a few different ones and I'll let you guys lead the conversation.

Speaker 2 00:01:37 Yeah, yeah, sure. So the way Kenny and I look at the glass industry is, they made some phenomenal step function changes, however, glass has stayed pretty stagnant and pretty much the same for the last 10 to 15 years. You know, float glass is not a new technology, but it's, you know, a fundamentally great strong piece of glass that's floated on a bit of tin. And some of the, some of the major improvements that have been made are around the coating world of glass. So low-emissivity coats that do a great job of essentially only allowing the visible light spectrum through and blocking all of the other nonvisible wavelengths of light. So you get really good energy performance to the tune where these silver soft coat Low-E's are about as optimized as they're going to get. And so, so you're at kind of this limit state of what you can do in the world of Low-E in terms of soda-lime, float glass manufacturers.

Speaker 2 00:02:29 I, they might eek a little bit more performance out of these, but we're pretty much seen, uh, I'd say a stalemate at that point in what we can do with float. And so Kenny and I have both been just staying in tune with industry and with, with startup companies or adjacent market sectors to see what's new or unique in the world of glass, and quite a few out there that we see - a couple of which we'd like to talk about today - and just give a little bit of insight into, into the market. So Kenny, you know, I guess we could start by chatting about diamond glass and kind of the genesis of what we've already talked about from the podcast prior of this thin, strong glass.

Speaker 3 00:03:07 Yeah. It, like I said before, this one's near and dear to my heart, cause I think it solves a really big problem, which is the weight of our products. And I think going ultra-thin and ultra-

strong allows us to build pretty much all these technologies together, to where, we're gonna take glass to do a lot more than it's ever done. So I think diamond glass is a key component to a building block for all the technologies that we're gonna talk about, probably, in the next 10 years.

Speaker 1 00:03:30 And you said it's 40% lighter than regular glass?

Speaker 2 00:03:34 Yeah. It makes the overall system about 40% lighter. It's a lot more than 40% lighter. So if you think about door glass today, it's about a 5 millimeter piece of glass, 3/16<sup>th</sup> of an inch. This thin strong glass is, instead of 5 millimeters, 0.7 millimeters. So you're talking significantly thinner and that results in, uh, a significant weight reduction. There's some fixed weights within the system hardware and framing systems, everything else. Uh, but you have a really tremendous reduction in how much glass mass there is with this thin strong glass. And it's a different technology than, uh, soda-lime float glass, which is what the entire industry, uh, uses and has used forever. It's, what's called a fusion drawn glass. It's a different chemical composition. So it's very strong in the annealed state and a little bit more flexible before it would break or sheer. So you can, you can actually handle these very thin pieces. In fact, if you wanna talk about willow glass a little bit...

Speaker 3 00:04:37 Yeah. And we're kind of borrowing the technology from the iPhone. So I think if you dropped your phone 10 years ago, instantly broke, right? And then what we're seeing now is new generations of this thin glass that's becoming stronger and stronger. So we're working with technology very similar to that as you, in the last few years, same thing with the window, it's stronger, it's lightweight. And it resists a lot of the, the same impacts that your phone would go through, and so it's adding a lot of value to what we're doing.

Speaker 2 00:05:03 And you, you see some of this glass and it actually, they can draw it so thin to the point where they can put it on a roll. And so, it's really interesting to come from, you know, big plate or float glass type world to see this roll of glass and someone walking down the hall with a roll on their arm that that happens to be a true glass substrate.

Speaker 3 00:05:22 It's a good point. The one we're using currently is 0.7 millimeters and the willow glass goes to 0.1 millimeters. So it it's ultra-thin.

Speaker 1 00:05:30 Wow. And so it wouldn't need all of the same kind of treatment that the current float glass needs?

Speaker 2 00:05:35 Right, so instead of, you know, take standard float glass and, it goes through a process of cutting, score, break and edge, essentially. So you put it on a cutter, you get a nice edge grind on it, and then you treat that glass. So you put it through a tempering furnace and get it to either heat treated or fully tempered for, for anything of size or, um, our design pressure. Uh, this is much stronger in the annealed state where what we've found is for large sizes, you don't need to treat it whatsoever. You do do the cut and edge grind process, but no more treatment. And when you have no more treatment, you're starting with a, you know, basically an ultra-pure, iron-free glass, you have beautiful optics through it. And then it never goes through that tempering furnace. So that there's no, uh, what we call roller wave distortions or, or deficiencies in the aesthetics. Uh, so you're still partnering this with other pieces of soda-lime glass, but the overall makeup of your unit gives you not only lighter weight, but much better views.

Speaker 1 00:06:33 Wow. Okay. I have a ton of questions <laugh> but I don't think, I don't know if we could talk about 'em... Do you still need to put an inner layer with it then to make it impact-resistant?

Speaker 3 00:06:41 Definitely. <laugh> It, it's thin, but not, you still need a laminate between the glass.

Speaker 1 00:06:46 Okay. But it doesn't have to be heat treated first necessarily.

Speaker 2 00:06:49 Yeah. That thin component, the diamond glass never needs to be treated. The other pieces of glass, the, the soda-lime glass that you're coupling with it, they do have to be treated.

Speaker 1 00:06:58 Ah, okay.

Speaker 2 00:06:59 Now it's interesting. So Kenny found this stuff and started working on it in his small office alone when he was the, the lone innovator. And he started building test units with it. And we started with only using thin-glass and that worked beautifully in the test. Right. So, you know, we, we shot it with a missile. We impacted and cycled it and said, holy smokes, this works amazing. The challenge was, it's so thin that when there's a little wind outside, you look like you're kind of in a wonky building where, where the glass is flexing all over the place.

Speaker 1 00:07:32 Oh.

Speaker 2 00:07:33 And so just through the R&D process, we never sold one like that, just through the R&D process and actually installing it into a couple of, you know, a couple of real openings. We found that that was gonna be off the table in terms of what you could do. So you ended up with this hybrid blend combination of thin glass to take out the weight and soda-lime glass to keep the, the structure and integrity of just kind of the, the natural flow of a building, the aesthetics, the low-E coatings and everything else. So you end up, uh, like with many things, with this hybrid solution that's not quite what you started out with.

Speaker 1 00:08:03 Ah, okay. That makes sense. Yeah, that's awesome. I know. Um, there's definitely a difference between the salespeople who handle our products and the installers who handle our products and how they feel about sizes and how they feel about the bigger, the bigger pieces. The salesmen love it all day long, the installers. Mm. Not so much. <laugh>, they're not, they're not fans. So this will be an amazing product to have out in the market for them. Anything else about diamond glass?

Speaker 2 00:08:28 No, I, I, I think it's a stay tuned type of thing. Okay. At the early stages, we've used our innovation lab to sell several pilot units out into the marketplace and we're continuing to get feedback and learning from what we've done. And, uh, so far I can tell you it's been a very successful pilot where it's doing everything we think.

Speaker 1 00:08:46 Nice. And it's like all new technologies, right. It's probably on the higher price point and it'll come down over time, maybe.

Speaker 2 00:08:52 Yep. Exactly that. So, any of this new technology starts at a price point that ultimately scales with time. We believe there's a pretty strong value proposition for this glass and trading off, you know, a slightly higher material cost for some other savings. You know, one, some savings that we can control, like, uh, little less hardware cost or lighter balances, smaller frames that can house the smaller glass. So there's a little bit we can trade off there. And then just the value for our

customer, you know, less wear and tear on your installation crew, you know, the ability to not use a crane and actually carry this unit, uh, with just a two-person lift. And then we continue to work on the sell-through and value-add to the homeowner who, we give them better views, more ease of operation. Think of these big sliding door panels that weigh 400 pounds. Or if you can cut 160 pounds of weight, it's a lot easier for someone older or someone that just has a very large product to move and operate that, and some other ancillary benefits.

Speaker 3 00:09:53 Maybe you can tell him the blind study you did with Bob Keller.

Speaker 2 00:09:56 Oh, yeah.

Speaker 3 00:09:57 In the truck. I thought that was pretty interesting. Yeah.

Speaker 2 00:09:59 Why, you tell this story?

Speaker 3 00:10:01 I wasn't there <laugh>

Speaker 1 00:10:02 <laugh> Those are the best ways to tell the stories, when you hear it secondhand, and embellish as you go.

Speaker 2 00:10:07 So yeah. So we, one of the ways to validate this diamond glass was to tell everyone nothing. And Kenny went ahead and rented a couple of trucks and built some wall sections within these trucks that had two windows side-by-side, one with the lightweight glass, diamond glass, one with standard, and door panels, one door panel with diamond glass, one with standard. And so as a quick trial run, you know, we went on a road show and took this to our customers to let them go ahead and install this glass or these windows and doors side-by-side, without telling them anything. They didn't know one had lighter weight glass, or anything like that. So, as a little prep to that, brought some of the executive team over into the truck and it's this hot truck and you got these windows laying there and two door panels.

Speaker 2 00:10:54 I said, "All right, guys, like you've installed windows - some of you - like pick, go ahead and go ahead and pick it up and put it into the opening." We started with the windows and it was Bob and Brent were there. And, you know, you picked up window one. It was like, "Wow, that thing's, that thing's heavy." And that was actually the, the diamond glass window. And you picked up window two. And it was like, "Oh my, you gotta be kidding me, forget this." <laugh> Then we moved to the doors and with the doors, it was even more pronounced cuz you just have bigger square footage, so much bigger weight savings and you picked up door one, and Bob and Brent could lug this thing into the opening and get it in and said "that wasn't that bad," and kind of felt, felt strong. And then they went to the next one. There was the standard glass. There was no way, there was definitely, I, I won't name which one, but one of them said, "forget this," and walked away from, from the standard door panel. And I, I, I think that kind of sold the idea of, "Wow, this stuff really makes a difference."

Speaker 3 00:11:48 And it's one of those ones you don't think about when you see it on paper, but when you got on the field and our dealers and our installers usually have two people lift on door, and sometimes they have one, and it's just so viable when they lift that one panel and they can see the, the huge difference it makes.

Speaker 1 00:12:03 Well, and even just in the samples, like, I look around the samples every now and then I'm like, "Man, these things are heavy and they're only two feet." Like they're small and they're heavy. I'm like, "Man, I'm, I'm glad I don't have that as a job." I would not succeed.

Speaker 3 00:12:16 It's, it's brutal. We've tried it a few days.

Speaker 1 00:12:18 Hats off to those of you that are doing it because it is, it is tough work.

Speaker 2 00:12:22 And it's a testament. You know, you have a, we have an engineering team that it's just phenomenal. And one of the things I love about them is they're, they're hands on, they're customer centric, and they've actually installed windows. They've installed their friends' home, their aunt and uncles' home, their own home. And, and so they know what it's like to pick up a door panel. It's not theoretical to them, right. Or it's not, "Hey, you know, that's too bad." These things are really heavy cuz they life safety products and show me anyone else's in the industry that's lighter and there's no such thing. In doing what they do and being hands on and really knowing this business inside-and-out, it really helps them to, to know the value of solving these hard things.

Speaker 1 00:13:01 Sure. That's awesome. I love that story. Okay. So we wanna talk about switchable glass and that's the same as dynamic glass, right?

Speaker 2 00:13:10 Yes. Uh, switchable glass, dynamic glass, electrochromic glass, they're, they're all kind of synonyms for another way to put it would be, we coin it here, consumer-controlled privacy, but it's basically, a homeowner can tune the glass between a nice, clear state where you can see to a privacy state where it provides either complete privacy, or glare, or solar control to give them much better occupant, comfort or privacy within the home.

Speaker 1 00:13:38 And we have a sample of that in the iLab, which is oddly enough, the bathroom door, which had me a little freaked out. The first time I was shown that I was like, "Hmm, I don't know if I trust that, that's weird. It's a lobby." <laugh>

Speaker 3 00:13:52 It hasn't failed yet.

Speaker 1 00:13:53 It hasn't failed YET. <laugh> No, I'm sure it won't, but it's still a little unnerving to be like, "Okay, there's a clear door and it's a bathroom. Hmm. "

Speaker 2 00:14:01 We like that idea where it forces some conversation about it, of what's this clear bathroom doing at the front of the Innovation Lab. Yeah. It just felt to Kenny and I like it was the right place. Cause it is a little unnerving, but it generates conversation.

Speaker 3 00:14:15 And it drives home the idea of privacy. In a, in a really good way.

Speaker 1 00:14:19 Be sure to tune in for upcoming episodes to help you understand the fenestration industry, what you need to know when buying windows and doors and other related topics, you can find out more about us at [pgtiuniversity.com](http://pgtiuniversity.com). You can also find us on Facebook and LinkedIn.

Speaker 1 00:14:38 Yeah. Well, I know, I have used it. And then, so then I'm all comfortable. Like I flipped the handle so that it goes private. So it's, so no one can see it and then I'm like, "But did I lock it?" <laugh> Like, "Oh no!" <laugh> I get all, all, uh, focused on whether or not the privacy glass is happening. But then I, you know, like, "Oh, I don't know if I lock that or not. I hope nobody's coming."

Speaker 3 00:14:58 Yeah, we made those instructions specifically for that.

Speaker 1 00:15:00 Yeah. I didn't read those. I, I adopt the engineering attitude and I don't read instructions.

Speaker 2 00:15:04 I, uh, we get it.

Speaker 1 00:15:05 <laugh> So what would be a great use for something like that? Like obviously a bathroom may not be the ideal, but like a bedroom or, um, maybe you're sliding glass doors? If you've got neighbors?

Speaker 2 00:15:17 It goes along with construction and home trends, right? And so what we're seeing again is modern contemporary construction in popular destination states. Uh, lot lines are getting tighter. Homes are getting more modern with more glass and, hey, Florida's a sunny place. And so, as you have these boxy, all glass homes, you have the beauty of "Boy it's light and bright inside." But to be able to tune that for when you either want privacy or you want to control, uh, the glare on your television or in your family dining area where the sun's just going down and it's kind of shooting a, a ray beam on some side of the table, those are the perfect applications for a switchable glass that has, uh, solar-control built in where you can literally open an app and say, "Hey, instead of full, visible light transmittance, I want to go down to 2%." And that will go dark to the tune where, acts as a solar shade on whatever area you'd like to control.

Speaker 3 00:16:17 Yeah, and typically in these homes that are mostly glass, you always have blinds and automatic blinds and other control systems. So this, this is a really good solution for those homes. And it makes a lot of sense when you're looking at automated blinds on large pieces of glass, this is a really good way to, to get the same effect, but in a better way.

Speaker 1 00:16:34 Nice. Yeah, because you can still see out a little bit, right.

Speaker 3 00:16:38 It depends which technology you use.

Speaker 2 00:16:40 There's a few different technology, Sherri. So, what you're looking at in the iLab bathroom is one technology that is not really tunable. It's kind of a scattered dispersed privacy. So it can either go clear or privacy - full privacy - but nothing in between. That technology is called PDLC, polymer dispersed liquid crystal. And so think of, you know, glass and an inner layer sandwich with this special film in the middle that has a whole bunch of particles on it. And when you put no current through it, it's in the privacy state. Those particles wanna stay very scattered and they don't wanna allow direct light through, only very diffuse light. And then when you put a current through them, like when you activate the door handle in, in our bathroom, it puts a charge to those particles and those particles all want to get in a row and line up.

Speaker 2 00:17:31 And when they line up, it lets the light through. And so that's the way that technology works. There's other technologies that work in a very different way, that aren't a polymer dispersed liquid crystal, uh, but are more of a tunable tunable type of product. And they might not go, you know, all the way to complete opacity or privacy, but they can do anything in between. So they can go nice, nice and full, clear light. And, hey, if you just want a little bit of glare control, you can go to 30% visible light transmittance, or if you want nearly full privacy, you can go down. So there's just different technologies out there. There's so many startups coming up with other ways to do it as well. Uh, we try

to stay abreast of everything the industry's doing. There's a few we definitely can't talk, but what's in the market today, and what dominates the market today is that PDLC technology that I talked about, as well as electrochromic, which would be like sage or view glass that make that kind of tunable tint type of product.

Speaker 3 00:18:29 I think it's probably worth noting. We've been looking at these technologies for 10+ years.

Speaker 2 00:18:34 Since before, uh, Uber and Lyft came about. Right. It's where we first it was where we first discovered Lyft. Right. <laugh> Right. So it was a little startup, but yeah, there's all these startups in Silicon Valley that are developing, much like any industry, something that is somewhat stale or has stayed the same. I talk about the float glass industry in some regard like that. Hey, I'm not knocking 'em, they've got great technology that's worked and it's been the workhorse forever, but there's a lot of people trying to knock off or shake up what you really can do. And so we try to stay in touch with different startups in different capacities and just see, uh, what they're coming up with. And most don't make it, but the few that do you really want to be in contact with them. And so a long time ago, Kenny and I went out to, uh, San Francisco, to look at early electrochromic glass type company. And it was really compelling, what they did...

Speaker 3 00:19:27 The price point was compelling.

Speaker 2 00:19:27 And the price point was, you know, finally, they didn't ever get there, but the goal was to get it to a residential-type price point where you could actually use this, not just in Jeff Bezo's home, but in, in more normal homes.

Speaker 3 00:19:41 <affirmative> Jeff Jackson's.

Speaker 2 00:19:42 <laugh> Yeah, yeah, yeah, yeah, exactly.

Speaker 1 00:19:44 Nice. It takes that long, sometimes, for a new technology to be from the drawing board, blueprint stage, you know, where you're running it on 3D printers and things like that, into the actual stores and the actual places in the market where people can buy it.

Speaker 2 00:19:58 So, oh yeah. It's a, it's a heck of a journey and, and we've seen some phenomenal things that 1x1 inch type sizes. And then if you go through the next room, they're scaling it to a 12 in. x 12 in. size, and the amount of work, effort, and time, and capital, that it takes to go from that 12 x 12 thing, that'll just blow you away to full scale production. That's where there's a pretty huge chasm And so...

Speaker 3 00:20:23 It's kinda like, it's kinda like the mantra, the, "Invent. Build. Deliver."

Speaker 2 00:20:26 Exactly.

Speaker 3 00:20:27 We've met a lot of companies that invented something that's been amazing, but have failed to do the build and deliver side.

Speaker 1 00:20:32 Right. Um, so there's one more around glass that we wanna talk about in today's episode, and that is the power-generating glass. And I think if I remember correctly, that's called photovoltaic glass.

Speaker 2 00:20:45 Yep. Exactly.

Speaker 1 00:20:46 Look at me, I can say big words. <laugh> I don't know how to spell that, but I got it. I know how to say it. <laugh> So what is that? So that's like basically a solar panel that's not ugly and dark on your roof, and it's instead a clear window that is now working to generate power?

Speaker 2 00:21:02 Yeah, exactly. It's exactly that. Remember I told the story about low emissivity coatings and, low emissivity coatings, they've been around for a while. They've gotten better and better. And they're amazing at letting only visible light through, that, you know, light has a lot of wavelengths. Only a very small portion of those are visible, and it blocks everything else. This is an example of, you know, some unconventional thinking. So we think we've optimized Low-E to the point where it can't get any better. Well, a company came along called Ubiquitous Energy, and a young guy, MIT student named Miles Barr, who's just a, you know, fascinating guy. He said, "I got an idea with this Low-E, we're letting the visible light pass through and were blocking everything else. What if I captured everything else and turned that into power?" And so he came up with essentially a very similar Low-E coating, but rather than just deflecting the nonvisible wavelengths of light to the exterior of the building, he transmits that to, uh, some bus bars on the side, some conductors, and captures the power and transmits that to whatever use case you desire with that power, whether that's powering something right at the frame, or whether it's putting it back into the grid, or whether it's powering the lighting or other systems within the home with that type of glass.

Speaker 1 00:22:18 And we have some of that, and I've seen it, it's in the back in the manufacturing space here at the iLab. And so my understanding is that, like, the little rechargeable drills and things are now being charged from that window and they're not being plugged in.

Speaker 3 00:22:33 Exactly. And I think it's probably worth noting on that one. It's just the whole concept of using power where you can generate it is ideal. It's the most efficient way to do it. So I think, I'm actually really excited about the power generating glass. I know it's something that we haven't talked about before, because it's been so far out, meeting with Ubiquitous. It's awesome because it's, they're pulling that in and it's something that we can actually utilize. And I think, to me, this is where we kind of jump from one curve to the next in our industry. So I, I think, maybe a good analogy, I know it's not exactly the same, but we used to buy ice from people that lived in the north on frozen lakes. Right. And they cut the ice, they shipped it down to us and it was very labor intensive to get the ice from Michigan to Florida.

Speaker 3 00:23:14 And then it wasn't those same companies. Then somebody invented an ice factory and the ice factory was amazing, right? Cuz you could buy local ice. And I think before my time, but some dude would deliver big blocks of ice to your house and that was step on the curve. And then this next version is another step in the curve where it's like the refrigerator, you have your own little ice factory. You no longer have to buy from somebody, you build it and use it exactly where you are. And to me, we're not there yet, but I think this type of technology gets us closer to that, to where, you can be off the grid, you can have this amazing house in the middle of nowhere and you're generating power with the windows that you have and you're using it right where you are. So I think this is just one of those technologies that gets us there, on the curve.

Speaker 1 00:23:57 Mm. My grandpa did that . He was, he uh, carved blocks of ice out of the Mississippi River as one of his first jobs before he became a fulltime farmer. Yeah. No serious. Like

honest. Yeah. That's awesome. So I love that, that we're on the front line of what's happening in the industry, and that you guys are so proactive about exploring other technologies and finding other industries that are using similar things. And then how can we apply that to what we're doing here? So that's fabulous.

Speaker 2 00:24:24 Yeah. It kind of, it kind of shows you what the iLab is all about, cuz those are future things. You know, they're not, they're not gonna generate revenue today for the iLab. However, we're funding that innovation off of selling some unique and specialty products into the marketplace and taking the, the revenue and profits associated with those products and pumping that into, not only new designs that we can continue to generate revenue with, but these future things that are definitely going to provide significant and meaningful revenue in the future. Maybe not all of them, but, but one of these technologies.

Speaker 1 00:24:55 Right? Yeah. That's amazing. I can't wait to not have an electric bill. That'd be great.

Speaker 2 00:24:59 Yeah. Yeah. Continues. It continues to seem to be, uh, more and more meaningful, right?

Speaker 1 00:25:04 Right. Yeah. Yeah. Especially in July, you know, when the air conditioning's running all the time and my electric bill is a little higher than I like it to be. So yeah. Keep working on that. That's awesome. Any other thoughts around glass technologies?

Speaker 2 00:25:17 No, I think they're pretty limitless. That just highlights a couple. We, we wanna keep time relatively brief and just highlight a few. Uh, but that's definitely not all of the use cases that are out there. There's so much more to come in the world of glass.

Speaker 1 00:25:29 That's exciting. All right guys. Well, I appreciate your time. Thanks so much.

Speaker 2 00:25:33 Hey, thank you, Sherri.

Speaker 1 00:25:34 PGTI University is the Customer Education Team for an entire family of brands. We began with the original EZBreeze porch enclosure line, then became PGT, America's leading brand of impact resistant windows and doors. We then added CGI, CGIC, WinDoor, Western Windows, New South Windows, Eco Windows and Doors, and our latest acquisition, Anlin Windows and Doors. We create products built to withstand major storms, keeping people safe, secure and prepared. Our exceptional brands give you the protection you need without compromising design or functionality. PGTI University is here to educate YOU, our listener, so that you can be more informed about window and door products.