KUEHNE+NAGEL

Kuehne+Nagel's **Inside Semicon**

Episode #9

Silicon and its uses beyond Semicon

Intro (0:02)

Welcome to a podcast series Inside Semicon In today's episode, we will be discussing how silicon has defined a semicon industry and is now also starting to define other industries such as watchmaking. Hi John, Good to see you again Tom, today here on Inside Semicon, we're talking about silicon again. It's an interesting topic and yeah, first thing I, I thought when you mentioned silicon was like that's sand, right.

What is Silicon (0:41)

So help me out here, explain to me what is silicon exactly before we dive into the details. Yeah, silicon is a rather unique material in the fact that it can be used and manipulated to make a lot of various items because of its properties. When it's manipulated correctly, it has a low thermal coefficient of expansion, which means that heat does not really affect it to such a large degree as a stainless steel. And it's also not affected by magnetic forces, which means obviously then that it doesn't, you know, show through north or through South. So there are some inherent abilities within the actual substance that allows it to be used for a specific and more dynamic areas that it can focus on to allow it to get the best out of devices that you wouldn't think because everybody thinks, you know, silicon, silicon chips, you know, semiconductors, you know, yes, it conducts, but yes, it insulates. So it's a semiconductor. So it's also to be used in its purest form with silicon itself.

Silicon as a material (1:57)

And I mean, one of the areas that I wanted to talk about, we were mentioning about spares, but I wanted to take a bit of a break the paradigm, so to speak, and get people to think outside the box here on this. So one of the areas obviously is, you know, it's something that not a lot of us have, which is time. But we have, you know, as an example here, I have an old Casio watch. It's completely digital. Everything in there is digital, you know, from the LCD screen to setting to pushing the buttons, you know, it's all basically made on in terms of the silicon inside. So it's an actual digital watch. Yeah, nothing analog about that. Yeah, exactly. Correct. So that's a very, you know, important one. But then obviously with people examining, you know, the new structures and the new lattices that go into making silicon. And I have my iPad open, so I wanted to make sure that I give the right dates here.

So people started experimenting with silicon in around 1990s and a person called Ulysses Nard and Freak in 2001 actually managed to kind of break the paradigm with silicon. And what he did was he actually, you know, managed to manipulate silicones into, you know, springs and coils.

Silicon used in watch making (3:18)

So obviously with the watch industry always trying to improve and had to pack more into a analog watch that likes to say, you know, Rolex or Swatch Patek, you know, the high-end ones, they want their watches to be obviously, you know, even more precise. And they thought, well, if we take out the stainless steel elements and replace them with silicon, then, you know, we can get a bit more in heat doesn't affect because the thermal coefficient is lower by silicon. Also, it means that magnetic fields doesn't affect the movements, the tie movements, so they're even more precise. So then what you end up then with is, you know, basically it's an old broken watch that I had lying around a bit of a hoarder Tom. So I always tend to keep these things for some reason and they always come in handy in these podcasts. But here you can kind of see through the face. And obviously for, for people listening, it's easy to look this up online that when you expand out the analog watch, you will see all of the, springs, the cogs and the fulcrums and the hairsprings are inside in this. And then these high-end watch manufacturers then at the end of the day, they decided to incorporate them into the watch. So it's more about the fact that silicon is actually crossing not just from the digital, but now it's going into analog, which is kind of a dilemma in the way that silicon was designed to basically carry. You know, we're using it to carry signals, digital signals from point A to point B Yeah. Now we're using it in an analog world. So now it's actually physical springs, physical cogs and physical moving mechanisms. Because most people that don't know anything about semiconductors or chips or whatever, like they will think of silicon as purely something that's used in, in semiconductor manufacturing, right? But what you're saying now is actually it’s progressing past that we're using in so much more forms and applications.

What are the benefits of using Silicon? (5:01)

But aside from making the watch more accurate, because I think that's what it eventually does to these analogue watches, right? What are the other other benefits for, for watchmakers? I mean, is it, is it cheaper? Is it more expensive? Like what what's their decision process? Yeah, I think that on that question more so about obviously silicon is, is way more accessible. I mean, and it is it is cheaper, obviously. And I think what it does as well as it allows people to be more creative with the timing mechanisms. So in each, you know of the watches you have even that are analog, you have alarms on there. You know, you have different abilities to change the date and the time. So the lighter the watch is, I mean, you can have a watch which can do a lot, but then it needs to be maybe 12/13/14 mil thick if you've different complications in there. But by having silicon and it's lighter, you can have a bigger watch, but it actually feels lighter than a watch is half a size with half the complications. So it does give the watch industry the ability to to make more complications in the watch and then not have the restrictions of, you know, heat or, and if it's if it's near a magnetic source that it would start losing time, you know, seconds over an X period of time. Plus, I think as well to manipulate silicon, it's probably easier than stainless steel. Silicon is very pure. With stainless steel, you do have impurities, even though you do have higher grades of stainless steel. But silicon is so pure because obviously it's made in a process where the manufacturing process is built in a clean room. So because of that, you can be 100% sure that the actual process and the actual purity of the silicon that goes in is there. And it will never, you know, degrade, it'll never corrode and there's no inherent flaws in it. So the, the, the structure is actually very strong, but it does allow them then to maybe think outside the box as well. If they can pack more in and have these silicon springs and silicon cogs turning, you know, can they actually have a smaller, you know, cog turning a bigger cog to allow more energy to be stored internally to try to get to a perpetual watch? In the old days, they had the one where you could move your wrist and you could wind the watch. But then you had to have a fulcrum in there, which is quite heavy because it had to also be able to move around. But if you made that from silicon, that felt a bit lighter. But then that would have to drive something else which had to be made from silicon. So it does allow them, I think, to think a bit further on the watch design.

Why are industries moving towards Silicon? (7:30)

So the watch industry is really moving towards using silicon instead of stainless steel. I think that there are. It's opening up. I mean, it's only been around since 2001 and I think since maybe I'm taking a guess here, I'm sure there's some, you know, chronologist out there that will probably, you know, grit their teeth when I give dates and times. But probably 2016 here, I think is when they really opened up to actually saying, yes, we are installing this now in our watches. Yes, we are officially using it. So on the particular, you know, spring, it's now called Siloxy. I think it's, I don't know if it's patented by Rolex, but they're actually saying, you know, we use this in our watches, yes, we're using silicon springs, yes, we're using you know, hair springs, etcetera. So it's becoming an accepted fact that silicon is now being used within there. But the next step for it obviously is really what they can think of to make with the next step of silicon. All right, so having heard all of this, right, what are there any drawbacks for using silicon over other material? Like what are there any disadvantages? Honestly, I can't think of any, to be honest with you. I mean, yes, silicon is brittle, but if you're wearing a pretty expensive piece of kit, you're not going to be, you know, hopefully banging your wrist against the wall to break it anyway. So it does have the ability that, you know, it is brittle. It's not very flexible. I mean, there are companies that are currently trying to experiment with making flexible, you know, integrated circuits and so on. But I think that the positives far away the negatives, you'll always have some negatives with any of course. But I think with this, it's I at this moment within the watchmaking industry, I, I can't see it. I mean, maybe another industry could be pens, for instance, that when you're writing with a pen, you have the stainless steel ball, which is in the top of the pen, you know, so to speak, You know, like when you have the pen itself in the top here. This is a digital pen, so I don't know why I'm showing it to you, but there's a ball in a normal pen. So maybe if that ball was made from silicon, Yeah, then, you know, and made in a clean room, then they can get the dimensions perfect. And then you don't have the stutter sometimes. So maybe with the higher end, you know, Mont Blanc's pens, for instance, that they would use silicon in that as well, you know,

What are the logistical demands of Silicon and how do we transport it? (9:45)

And then reverting back to, you know, our industry logistics, right? And of course, we're mainly focused on high tech and, and the semicon industry. How do we have to deal, do we deal with any challenges related to, you know, transporting silicon? I mean, is it because you said it's brittle in terms of logistics where, where do we have to adjust our standard processes? I think it's mainly when we get the move the silicon actually silicon ingot it comes, you know, and I think it's half a meter high and it can be different, different sizes in diameter. But as you said, in that form, it's not so brittle. It's when they start chopping it up into small little wafers, then that's when we have to be very careful.
But what we find then is that from a logistics point of view, we have to watch simple stuff like vibration, you know, I mean, if you've got a glass, you know, and if you keep tapping it enough, the, the, you know, the harmonic frequencies will build and build and build and then it'll eventually shatter. The same with the, with the silicon, if you're transporting that. And if you don't have, as an example, an air right truck as opposed to an old spring truck, the those vibrations can cause damage to, within certain tolerances of, of equipment that's been shipped. So from us to have to, to look at that, I mean, ideally we would have a maglev truck, which would be on a, you know, how to say magnets and then that would go from A to B. So, but unfortunately we, we're not there yet, but it's something that we, we are, you know, looking at, but we also have that as well from removing the parts around the warehouses. You don't just put in a pallet truck and move a point A to point B. You actually have air ride like hovercrafts, so to speak, but they're smaller. But then that actually allows a cushion of air so that there is no vibration coming through. And if it goes over a small, you know, dent

or or whatever in the warehouse, you know, the equipment does not feel that. So it's all the time. It's about removing not only the vibration, but any external things like humidity, temperature control, air control, et cetera.

How is logistics adapting to the Semiconductor industry? (12:10)

But that's how the logistics industry is continually changing and we have to continually adapt, you know, for that because not only are we shipping, as an example, watches out the front end, that's worth, you know, a lot of money from the point of view of it's a watch. But at the back-end room, they're actually making some of these internal workings, even though that equipment is still very expensive. Some of the raw materials like silicon are cheap. So we do have a dilemma in that we have to be, you know, high end at the front. And then we also can ship on pallet trucks and normal regular trucks at the back. But we do have to incorporate them. And that's quite a tough logistical challenge to know at what point of their process do we put in the particular equipment to protect their value of merchandise. And that's where it really becomes significantly important that we understand what our customer is doing, right.

I think I've said this a few times is that I also wrote an article on the Semiconductor Digest that unless we're inherently engaged within the process and the future of what they're developing, we can't develop a supply chain to allow us to ship the product the way it needs to be shipped. If you already have a product and you said, OK, I need a ship today, it could take us a couple of weeks, couple of months and maybe even a year to understand how we need to ship this to their particular requirements. Whereas if we were involved in the in the new releases or knew what direction they're taking six months before they released the product, then we could actually build the supply chain around moving that product from point A to point B. So I think that communication and also the customer bringing us more into the fold to let us know what we can do when it comes to the especially semiconductor shipments, how we can actually overcome any of the problems that can result in damage to their product.

What is the future for Silicon? (13:58)

So back to silicon, right? We're using it in watches now or the industry's using it in, in watches and many other products. Where do you think this will go in, let's say 5 to 10 years? Will we see silicon in, in everything or I think there's, it's a good question and it's again, kind of hard to look into the crystal ball, but I think the way it's going is that yes, the digital side will always have it. And, you know, we're now in the AI age, which, you know, came out of nowhere really. Umm and I think that within the products that we're using, we're always looking to make things BA faster, quicker or cheaper. Umm, so it can actually cut across areas in the analog world that we would not have thought about. So like I said, like maybe the next is is pens. Maybe they're already doing that. I didn't look that up actually, but maybe pens are next. We have watches, umm, I mean, could it be that there's, I don't know, like silicon stands for televisions. Could it be that we're making, you know, the pots and floor out of silicon? You know, it's a very reusable, recyclable product, silicon, umm, cheap to manufacture and it's just plentiful. So I think if there's a way for people to actually exploit would be the bad word. But to use the silicon, to exploit the silicon and the properties that it has and to find a niche market for it, then you don't know where it's going to end up. You know, there, there will be areas where we can probably find, you know, a new arena for it. I don't know, maybe windows, you know, it could be and it could be anything. I mean, you know, because if you want black or blinds, you know, could they be made from Silicon? You know, that if we can manipulate it enough, you know, can it be that you, you didn't pull down your silicon blind because it's black, It's impervious, you know, to light if the stick enough. So yeah, it, it, it can be in anything. But I think it's just that people have to rethink the materials that we we're using currently. You know, we're still heavily reliant on the plastics. We're still heavily reliant on steel because of the strength. But if you have something that doesn't need too much strength for load bearing, then I think silicon, you know, maybe an option. But again, that's me summarizing and theorizing. But, but it's still, it's, it's amazing to me to think that all of this came from the development made in the last 20 years in semiconductor research, right? That's amazing to me that we're already progressing and using it in our daily products and, and items that we use every day. And then to take another step back and say, well, initially silicon is, is well manufactured from sand. That's yeah, it's, it's almost mind blowing. Yeah, it is that they can know when the most, you know, it's like, yeah, sand, you think of water. it's everywhere and it's, you know, it's, it's quite malleable. I mean, you know, sand is used to make glass, you know, so, so the, the lattice properties of the glass and this and this the semicon it was the actual silicon are kind of the same. So it's just a different process we put it through. But actually on that there is talks of maybe glass quartz taking over from silicon. So we could be going again around in a circle in a couple of years if they managed to develop, you know, quartz and use quartz instead of silicon. So it's a never changing, which is why it's a great, fantastic, you know, interesting industry. Yeah, it's always changing. There's always new things around the corner that we never thought about. Yeah, it's very interesting.

Outro (17:17)

And thank you for sharing your thoughts on this. Appreciate your time today and my watches and your watches. Yeah, and I, I hope everybody found it as interesting as I did. OK, Thank you very much. Thanks for having me. Thank you. Thanks for listening to today's podcast, Inside Semiconductors and the Semiconductor Supply Chain. If you found any of the topics we discussed interesting and you want to find out more, you can find me on LinkedIn at John Desmond or go to Kuehne+Nagels website.