UNITED STATES
INTERNATIONAL TRADE COMMISSION

In the Matter of:	)	Investigation No.
CERTAIN SEMICONDUCTOR DEVICES	)	337-TA-1366
AND METHODS OF MANUFACTURING	)	
SAME AND PRODUCTIONS	)	
CONTAINING THE SAME	)	
	)	

OPEN SESSIONS

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UNITED STATES INTERNATIONAL TRADE COMMISSION

Washington, D.C.

BEFORE THE HONORABLE CLARK S. CHENEY

Chief Administrative Law Judge

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International Trade Commission

500 E Street, S.W.

Washington, D.C.

February 26, 2024

VOLUME I

EVIDENTIARY HEARING - VOLUME I

The Hearing commenced, pursuant to notice of the Judge in Courtroom A, at 10:01 a.m. Eastern.

Reported by: Richard Germosen, FAPR, RDR, CRR

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CHIEF JUDGE CHENEY: We are now beginning the evidentiary hearing in Investigation Number 337-TA-1366.

The parties' appearances remain as in the final prehearing conference, and before we get into the admission of unopposed exhibits, do the parties wish to make opening statements?

MR. KOPSIDAS: Yes, Your Honor.

I believe the private parties and the Staff have all allotted a certain amount of time for opening statements.

CHIEF JUDGE CHENEY: Okay. I see on the proposed schedule attachment, complainants estimate about 45 minutes, respondents estimate about 60 minutes, and Staff estimates about 15 minutes for openings.

Is that right?

MR. LAVENUE: Yes, Your Honor.

MR. KOPSIDAS: We believe we're going to be a little faster than that, but yes, Your Honor.

MR. WINSTON: Yes, Your Honor.

CHIEF JUDGE CHENEY: Okay. Let's begin with the complainant's opening statement.

MR. KOPSIDAS: Your Honor, would you like us to make our motion to move in the unopposed exhibits first?

CHIEF JUDGE CHENEY: We'll do that after openings.

MR. KOPSIDAS: Thank you, Your Honor.

MR. ZEINEDDIN: Good morning, Your Honor, again.

Paul Zeineddin for complainants.

CHIEF JUDGE CHENEY: Good morning.

OPENING STATEMENT

MR. ZEINEDDIN: Your Honor, thank you for today. We've been waiting for this. We're going to have with us here a couple of witnesses from EPC admitted in this hearing. And just to be clear, what I'm not going to do is go through all the evidence that Your Honor is going to hear or what it is. I plan to only do a brief opening just to kind of highlight to the Court a few issues of what we believe that is going to be at the center of this hearing.

The witnesses you're going to hear from, the fact witnesses are Dr. Alex Lidow and Dr. Robert Beach, both of whom are co-founders of EPC, the complainant here, and both of whom will talk about their inventions and their company.

Dr. Lidow, as you will hear from today, Dr. Beach I'm not sure that he will go up today. He will go after Dr. Vander Veen, so chances are he will not be up today. Both of these gentlemen had worked before they worked together in EPC. They worked at a private company,

International Rectifier, IR. Both of them are Ph.D.s. One CalTech Stanford, one CalTech, Ph.D. They lived the life of semiconductors.

So our next slide is going to show our expert witnesses, and these are Dr. Fred Schubert and Dr. Thomas Vander Veen. Dr. Schubert will be addressing all of the tech issues in this case, be it the technical prong of domestic industry, infringement, the background technology issues, as well as responding to Innoscience's invalidity arguments.

Dr. Schubert will show how his explanations are going to fit, whether we're talking about validity, whether we're talking about infringement, and whether we're talking about domestic industry and the various devices across all -- both companies' products.

Dr. Schubert is a professor at Rensselaer Polytech Institute for 12 years. There he was the head of a program, future chip program. He also had worked in industry at Bell Labs in New Jersey. Now, this is the place, the birthplace of the transistor, although I believe he was not involved in that. That was prior to his time.

Dr. Thomas Vander Veen is our expert on the economic prong of the domestic industry, and you may be familiar with him. He's very familiar with the ITC as well.

Next slide, please.

Starting with the domestic industry economic prong. The evidence will show that EPC has significant investment in R and D in the United States. It's a U.S. company, started in the U.S., based in the U.S., with 43 R and D employees in the U.S., and this is based on the ITC requirement of the definition of R and D. 43 R and D employees in the U.S., with the vast majority of whom have advanced degrees in science or engineering. I believe 23 have a Ph.D., 19 others have master's.

When we're looking at the R and D specifically and parsing it out as to the core R and D, inside the transistors, this is the patented technologies, each one of EPC's transistors is based and grounded and built on the patented technologies. These are the two patents here, the '294 and the '508, the compensated patent and also the aligned gate patent.

All of the technology and further R and D on these technologies is performed exclusively in the United States at EPC. What we hear back from respondents is nothing procedural. They do not contest that EPC's investments in the U.S. are significant.

Next slide, please.

We're here to ask Your Honor and the Commission to give EPC a limited exclusion order barring all of

Innoscience's products from the U.S. and barring them from acting in the U.S., whether directly or with co-actors.

So, of course, we are right, but why are we here? Innoscience has systematically and methodologically gone after EPC. Over a period of, I believe, seven years they came after EPC, the startup company, in this very important technical area, and they started recruiting their employees one after the other. First, the marketing person who is very familiar and intimately knowledgeable about EPC's customers, potential customers, their needs and wants, and then technical people, research and development people, four people in seven years. The third one is a co-inventor on the patents asserted here, Your Honor.

The evidence will show that this is not it. EPC, having made the decision by their backers to really flood the entire world and satisfy single-handedly the demand of the entire market for -- in this decade, the burgeoning market of gallium nitride.

They have built a huge factory. They're in the process of building another with a huge capacity, raising a great deal of money.

They have come here to the United States to market their products, and you will see what they're saying as: Our products, let me show you pin to pin matching, same performance, everything is the same. Looks the same.

Take out EPC's chip and just plug in ours. It works. EPC is still a young and small company based in the U.S. with a little R and D in Europe and some in Asia. A few people, but other than that, they stand no chance without this.

Next slide, please.

I just wanted to highlight, Your Honor, I did have the opportunity to do so before we went on the record, this single claim in the '508 patent. Everything you see here in green, which is a lot of the elements, a lot of the steps not contested by their expert, and they will not stipulate to it even though they've seen our uncontroverted evidence that we actually satisfied that. And the two steps that are highlighted in yellow, I believe those are the ones that are at issue.

But as Your Honor had noted, we're going to present evidence for all of these, and we're going to have to plow through it as you mentioned, and for -- the way we're going to do it is that for each one of these steps, our expert is going to show the demonstratives with all the exhibits that we're using in support listed on them. So when the other side -- when they get it the night before, they will see everything we're intending to present, rely on, and move into evidence. There will be no surprise on which exhibit we're relying on, and we're going to do that very quickly and we're going to mix the confidential and

nonconfidential references to the exhibits and depiction on the slides, and for that reason we will likely be on the confidential record the vast majority of Dr. Schubert's presentation.

That does not mean, Your Honor, that you will not have public evidence to cite for each one of the steps. We believe that we will be able to give you the ability to do that, and we do not anticipate that Your Honor will need to make the actual infringement opinion confidential or at least the high level prongs therefore.

Next slide, please.

The '294 patent, you heard me talk to you at length about that at the Markman hearing. It's the compensated gate. Everything else they don't contest. That's where the issue is. That's where the issue is whether we're talking about any part of the technical case. That's the issue.

Next slide, please.

Right here, this is going back, I know Your Honor probably knows this already, but this is the structure of the regular transistor that's in enhancement mode. We have what's in blue, lighter blue or darker blue, that's below the gates, or there is a single gate below the gate. The left and the right, we have the source and the drain. The current that flows through the device, that's

supposed to flow through the device. The useful current is the current that goes between the source and the drain and the blue part, the light blue part. What controls that current flowing is what's above the blue part, and that's the gate, and most transistors, field-effect transistors or others, the gate is typically metal. In enhancement-mode, gallium nitrite transistor, the gate is made of two parts, one part that's metal, one part that's semiconductor.

Next slide, please.

Your Honor, I'm not going to go through this again to spare you. You have seen this in the Markman. There is a reason why I'm doing this. Basically, we've done a lot of these slides in these demonstratives, diagrams before. This is -- I'm referring now to slide number nine. You will be familiar with these from our Markman hearing. They show how in the prior part, the magnesium built part of the yellow part of the gate, the clicks empties the electrons that are lined up in the bottom part, which is the buffer, the light blue part, and that's how this device is actually on, which as you will hear more, and in the invention, the difference is is that yellow part of the gate, which is the semiconductor, is not only serving that purpose, the p-type acceptors, which are, for example, magnesium is not only serving the purpose of the blue team. Those two-dimensional electron gas

electrons from the barrier -- the layer all the way at the bottom, which is the light blue layer, the buffer layer, but also the other receptors are neutralized by hydrogen.

Next slide, please.

I just wanted to mention what you're going to be seeing a lot from our expert is this, this illustration, which is noted on CDX1, slide 10, it's the same thing that we've seen before. This is just more detailed in our own expert's preference for colors, but you're going to be seeing the same thing.

Next slide, please.

You will hear that the real science does not really refer to the right-hand side as we're looking at slide 11 of my opening here. This is not how engineers and scientists study semiconductor and understand how semiconductor devices actually operate. What's on the left-hand side is an energy diagram of how electrons, which are the elements that make a difference in a semiconductor, behave.

I flipped it on its side horizontally to show how it aligns with the physical product that has the gate on top and the source and drain on the sides. It's so that the yellow part, that's the p-GaN, that's the semiconductor part of the gate, the part that's in the middle, which is the darker blue, that's the aluminum gallium nitride

barrier, and the bottom part, which is the light blue part, that's the gallium nitride buffer layer where the electronic, the actual current flows, that's where you want the current to flow.

Next slide, please.

Engineers look at this and scientists look at this oriented this way, that whatever we're looking at vertical in the prior slide, that energy diagram, they really aligned it horizontally to look at it, and so this is, for the record, CDX12.

The key here is that what we're studying is not what's up and down in terms of physical height. What we're studying are the energy levels of particles.

At the bottom, we see the valence band, that line kind of that is just outlining the bottom. It's in red. That's actually a band. It's not just a line. It kind of continues just below, and at the very top, what we see, the conduction band, what's in green, that's line. That's the edge of the top band.

Now, what are these, and you'll hear about them from the experts as well and perhaps some of the witnesses. Going back, we've talked about this, the basic science, the model for the atom, the atom we have the nucleus and we have electrons that can exist in different orbits, but not in between quantum mechanics say have quantize energy

levels that can't exist in between. Well, when these atoms come together and they form a crystal, they bunch up together.

So those or bits kind of bunch up together and create a band where electrons would be, and the valence band, the electrons are tightly together placed, so they have no room to move, thus there is no conductivity of electricity, and then conduction band, those bands can be almost free, if not free, always free in the semiconductor, for example, that are intrinsic, and they are -- when the electron has enough energy to jump up to the next level into the conduction band, it can move freely up in the conduction band, because there is room to move, and that's why we call it conduction band, because electricity can be conducted there.

Electrons don't just exist in a single space like any one of those small particles. We study them by their probability distributions. It's not magic. When you have a lot of electrons, they all behave in a way that's predictable, but we look at every single one, and electron can exist in different places. We don't know what they are. We know where their energy is, but the key is it's a probability distribution.

Few electrons will always be a high level of energy, call them like electrons, they get to jump. This

is just the way life is. Probability distribution, most people are of average height. There are people are not very tall, others are very tall. If you look at two or three people, you're not going to get the full distribution. You look at a population, you will, and that's how electrons exist.

Now, if we look at the X axis of this slide, that is actually the spatial access. So you have the GaN buffer layer. You have the aluminum GaN, the aluminum GaN barrier, and then you have the yellow part of the gate, the p-GaN.

Now, where can an electron exist? You could be in the GaN buffer, but if your probability distribution is such that the tail end of it happens at the aluminum gallium nitride barrier and it goes beyond it, then you will exist there. Different models we try as engineers and scientists to quantize in simplifying equations --

(Stenographer clarification.)

A. We try as engineers and scientists to use equations that tell us the level that we need to know to solve the problems that we have, and we try to express it in different ways depending on the equations that we're using. Some call these -- when you have the electron existing because of its probability distribution in a given place based on its energy tunneling, and there are

different types of tunneling. It's well-known in the semiconductor.

Also electrons, because if they are in a place that's very, very hot, all particles get very excited. They have a lot of energy, well beyond what's between the valence and conduction band, the prohibited place, that bandgap, it can't be there. If you have enough energy to jump there, above that, you are in the conduction band, and if electrons are very hot, a lot of them are in a conduction band, and now the probability of them going over is even much higher. And so electrons get from the gallium nitride buffer into the p-GaN, and the bottom line, Your Honor, if you recall in the Markman, whatever is the semiconductor physics here, that's got to still satisfy the basic principles of science. Whatever somebody is going to tell you how these things flow, how these electrons flow, it's still going to satisfy the basic principle of science, and, by the way, just for the record, we talk about electrons, people talk about holes, holes is just the absence of an electron. So an electron jumps all the way through the conduction band, they leave a place that's empty, and that's a hole.

Now, the hole of the electron are one and the same for purposes of studying conductivity. Once a hole moves, a hole moves by having another electron in the

valence band takes its place. Sometimes we'd rather study that part over the part from the top of the electrons because the equations are easier.

But the idea of conductivity works the same way. The bottom line here is whatever model somebody is going to put before you, Your Honor, to explain things, that model has to still add up to still satisfy the basic notions. For example, the neutrality, when you have an electron that left an atom and created the hole and went somewhere else on the crystal, creating negative charge, you can't just look at the negative charge and say, This negative charge is going to do a lot of things, that there is a positive charge here balancing that. You can't just erase this and forget about it.

So any model or explanation that somebody wants to come up with to say, Well, all these devices with all these people have been working on for 16 years and the entire industry, they don't know what they're doing. Let me tell you how this works, and they posit something new, and the new science that they posit or the explanation on the model has to fit other basic principles.

Another basic principle, you can't just say that a particle vanishes. Matter is neither created nor sought. We believe, Your Honor, that what you'll hear from us is the explanation that everybody knows in the art and

that fits all issues, whether we're talking about validity or whether we're talking about infringement, we're talking about the domestic industry technical prong.

Your Honor, I'm sure, will be very keen, as you have noted in the Markman hearing, to hear what both parties will say about the basic dispute in science.

The last slide, just some quotes. I was driving, I was listening to NPR. There was a show of economics, and they were talking about Richard Feynman, a great physicist. And the idea is we as lawyers, parties, businesses, governments cannot dictate what science -- what scientific model is, how technology works, or what science is. Science is science. We've known that since Galileo, if not before, when we stopped thinking of the forms and started looking at reality to explain what's going on, and when somebody is going to give a scientific opinion or technical opinion, their technical opinion should provide all the grounds that make sense, not stop short of that. Nature cannot be fooled.

Thank you, Your Honor.

CHIEF JUDGE CHENEY: Thank you, counsel.

Let's move now to the respondent's opening statement. Just a reminder, we'll take our first morning break at 10:45, so your opening statement may be interrupted by that recess.

OPENING STATEMENT

MR. LAVENUE: Good morning, Your Honor. Lionel Lavenue from Finnegan for Innoscience. Thank you for giving us an opportunity for the opening statement.

What we have at Innoscience is a company that was founded by Americans in America. We have four founders that we show on slide two, and you'll be hearing from one of those founders, Dr. Wei Wei Luo, who is an American New Zealander, American kiwi. She grew up in China and then worked in New Zealand, was born and raised in New Zealand. Her family was from China, but she was born and raised in New Zealand, and then she moved to America, and when she moved to America, she wanted to find a new company, and she did so by looking at technologies that were on the forefront of new and exciting, and she met Dr. Weber. Dr. Weber from Germany.

Dr. Weber and her then found two others that had a similar interest, and the four of them created Innoscience, and Innoscience was created in 2015 in Gaithersburg, Maryland. 2015 they worked for two years, from 2015 until 2017, when they met up with a consortium out of Belgium named IMEC, and IMEC is an entity of universities and companies that pool all their resources to develop new technologies. And they developed different things, different areas, including semiconductors, and

within semiconductors they decided that they would look at GaN technologies.

So IMEC had already been working on GaN technologies well before Innoscience was even created, and so when they found that Innoscience was interested in partnering with them and developing the technology together, they established that partnership in 2017, two years after the founding in Gaithersburg, Maryland.

Once they began the partnership, they did two things. They exchanged technical information, and then Innoscience sent its engineers to Belgium to actually work on site at the IMEC with the IMEC engineers, and they developed processes and procedures for the development of semiconductor wafers and the fabrication of transistor devices. They did that, and then once they had created all that, they went and looked for funders. They found funders for the development of factories and they created two factories, and those factories are in China, in Zhuhai and Suzhou. We have a picture of those on the screen and they're very large facilities. It takes a lot of space to put all of these machines together.

Interesting, something that I found out whenever I began the case, was that the machines that actually create these semiconductors are all made in the U.S., something I thought was interesting, is that the big

facilities to put these together, you have to have plenty of room to do that, but many of the machines that actually create each of the layers, the design, the way that the wafers are put together, that is all based upon hardware that's purchased from the U.S. using the designs that Innoscience came up with with IMEC.

Now, the number of Innoscience products are very numerous. Innoscience is the largest GaN producer in the world, because unlike EPC, who does not have any factories, they don't have any ability to make their own chips. They have to make them using another provider in Taiwan. Innoscience makes all of its own chips. It has over 100 products. Many of those are off-the-shelf products that are shown on the screen. In addition, they make many customized products as well, so if you're a company and you want a particular GaN device for saving up to 10 to 15 percent of energy over silicon, then you can use one of their GaN power chips, and you'll save 10 to 15 percent.

Now, one of the things that I wanted to do for Your Honor is to give you an idea of what it looks like inside the factory. So when you're making these chips, because you'll be hearing a lot of things about the epitaxy growth process, that's where the wafer is actually grown from the silicon, up through the various layers, and then

after the epitaxy growth process, there is a annealing step. You'll hear more about that, the RTA, rapid thermal annealing, which is a heating process that has certain effects upon the wafer, and then there is the creation of the transistor chip. Well, in this video, short video, it's about three minutes, we go through many of those machines, and you can see how they're created, and it also has a little bit of background about Innoscience as well. So this is just a three-minute video clip.

(Whereupon, a video is played.)

Innoscience founded in 2015 leads the gallium nitride technology forefront boasting the world's largest integrated device manufacturer, IBM, that integrates and streamlines all processes in GaN production including design, manufacturing, packaging, circuit applications, marketing and sales.

Initially developing its technology based on its license with IMEC, Innoscience has developed the technology to now provide highly performing and reliable GaN devices for a wide range of applications and voltages. 30 volts to 650 volts with unmatched control over the largest world's only 8-inch, 200-millimeter GaN on Silicon wafer manufacturing capacity globally.

With the world's largest 8-inch GaN on silicon wafer, Innoscience is able to significantly reduce mass

production cost by increasing the number of GaN transistors held by a single wafer. Innoscience uses an advanced manufacturing process in its production fabs in Zhuhai and Suzhou. While Innoscience has the ability to satisfy the current world demand for GaN, the world demand continues to grow. Therefore, Innoscience is looking to build a third fab to satisfy the world demand.

Innoscience's manufacturing process includes two parts: First, the manufacturing process includes the epitaxy growth to grow the GaN layers on the raw wafer; second, its manufacturing process also includes fabrication to fabricate the structures of transistors on the GaN layers, including the steps of depositing multiple layers of thin films and forming photoresist of the pattern on top of the thin film and using photo etching to form the various electrode structures.

This fabrication process includes an annealing step where the wafers are heated to temperatures of up to nearly 900 degrees Celsius, which is approximately one-sixth of the surface of the sun.

Through advanced manufacturing tools and a commitment to relentless innovation with over 700 patents, Innoscience produces high-performing reliable GaN devices to power a diverse range of products, from power delivery chargers, to data centers and smartphones, showcasing GaN's

versatility and impact across industries. Their roadmap aligns with evolving application demands, ensuring adaptability to customer specifications.

While Innoscience is based in Mainland China, Innoscience has offices all over the world, including the United States, Korea, Japan, Taiwan, and Europe. Our competitors are not other GaN companies, but other silicon-based semiconductor companies. Innoscience's focus remains steadfast on leading GaN technology, envisioning a future where GaN produces power more efficiently to solve the world's energy crisis by using less energy and power than silicon-based products and where GaN powers technological advancement across global industries. Therefore, with our license and transfer of technology from IMEC and over 700 Innoscience patents, Innoscience is empowering the GaN industry as a whole.

(The video is stopped.)

MR. LAVENUE: And so, Your Honor, if we take Innoscience, which is the leader of GaN in the world, and we compare that to EPC, we note that there are quite a big few differences. We note that EPC does not have the ability to make anything, because all it is, it's a design house. It does not make any of its own chips. It has to send it over to Taiwan and have them made there.

Also, there is a massive distinction in the

amount of products that EPC offers. EPC only goes up to 350 volts in its products, where Innoscience goes up to 800 or to 700 volts. The distinction is that the higher voltage chips are much more in demand. 80 percent of the chips of the world that are sought for GaN are in the higher voltages, which EPC doesn't even offer.

So if we compare those side by side, there is quite a big difference, especially if you look at that last two points, the 8-inch wafer that Innoscience makes. Innoscience is the only company in the world that has the 8-inch wafer. EPC uses a much less efficient 6-inch wafer, and also on the issue of employees, Innoscience has 1600 employees. EPC has around 100 employees, a little bit more, and then I believe my counsel from the other side noted that three, I believe he mentioned, of EPC's employees had been hired by Innoscience to go over. Well, out of 1600 employees, that's a very small number. So the fact that one company that is interested in GaN has another company that's interested in GaN, this is normal process.

The fact that Innoscience has been sued in this case merely illustrates to us what we believe is EPC trying to force a larger company to bend to something that is improper with patents that are not infringed or -- and are invalid. The two patents that we're looking at, of course, the '294 and the '508 patent, and we're going to be hearing

from the inventors of these two patents. They're both founders of EPC, and so they certainly have a lot of emotion and feeling, and we don't begrudge that. We understand that they have emotion and feeling about their technology and about their company, but that doesn't mean that Innoscience does anything wrong here.

The '294 patent has three claims that are asserted. The 508 has one claim, rather long as you noted earlier, and in the '294 patent, we do agree with complainant that one of the things you'll be hearing about, if not one of the main things, is this issue of what is a compensated GaN.

A compensated GaN has to be looked at in the context of what does the patent describe in the title? In the title itself of the patent it is -- and it's listed here under item 54 from the patent of the '294: A compensated gate MISFET, and so if we define what a MISFET is, the word I in MISFET, metal insulator semiconductor, is insulator.

Well, one of the primary things that distinguishes us is that we are conductive, not compensated, not an insulator. So just from the title alone, before we get into the details, we're already looking at distinctions.

Also, if we look at the prior art, the '294

patent and the '508 patent have specific figures, which it cites at the very beginning of each patent, and it labels them as prior art. And then within the prior art, we can see that each of the elements of claim one is specifically identified in the prior art of the patent itself. The only element that is not identified as prior art is this compensated GaN, and so, of course, that is what we're arguing about, because the rest of it was already in the prior art.

The compensated GaN, the only element that is in dispute, and this is the basis for invalidity, noninfringement, NDI, all of the arguments you will be hearing with respect to all three of those issues deal with the compensated GaN issue.

Now, what is compensated GaN? You'll hear a lot about this. Well, the distinction that we think is the easiest way to understand this is the patent says the compensated GaN is insulating. It is specifically defined in the patent, as we have on the right side of the screen, by a compensated semiconductor layer of highly compensated semi-insulating material. Well, we do not use a layer that is semi-insulating. We use a layer that is conductive, and look at the very next line of the patent when it distinguishes its compensated GaN from conductive. It says in red: While the GaN transistor of the prior art is a

conductive p-type material. So we're conductive. They are compensated. This is the distinguishing fact between the two.

Now, it's interesting to note that when you are conductive, that's considered p-type material, and so p-type material is conductive, and one of the reasons that it's named that is that when you have a conductive GaN, it's called p-type GaN or p-GaN. So one could say in the words of Shakespeare, to P or not to P, that is the question that we have to resolve in this proceeding.

Now, with that, Your Honor, we would go on the confidential record because I will be going through the infringement issues, and if we could go into the confidential record, this is only confidential and -- well, it says confidential information on both sides, actually, that we'll be getting into.

CHIEF JUDGE CHENEY: Okay. Let's take our morning break. When we return, we'll be on the confidential record. We're off the record for 15 minutes.

MR. LAVENUE: Thank you, Your Honor.

(Whereupon, a recess is taken.)

CHIEF JUDGE CHENEY: Please take your seats.

We're back on the record now in the 1366 investigation.

Before the morning break, we were listening to

the opening statement of the Respondents, Innoscience, and now Innoscience has requested to go on the confidential record. We are now on the confidential record.

(Whereupon, the hearing proceeded in confidential session.)

O P E N S E S S I O N

CHIEF JUDGE CHENEY: You can give me a warning when we'll go confidential again.

MR. LAVENUE: Sure, will do.

CHIEF JUDGE CHENEY: We're now in the public record.

MR. LAVENUE: So for the '294 patent being invalid, we have the invalidity positions that will be presented by our expert, Dr. Lebby, and Dr. Lebby will be explaining that the patent itself, as we noted from figure one, has a specific list of prior art, and that prior art is going to identify what is old and what is claimed to be new. He will be presenting two grounds for invalidity. One using the Beach189 reference, and two using the Uemoto reference. I'm only going to briefly touch on the first one, although Dr. Lebby will be discussing both.

Interestingly, the Beach189 reference is a reference that is this is Dr. Beach, who is the same Dr. Beach that was -- that is in the '294 patent. The Beach189 reference, by the way, Your Honor, is prior art and it was not disclosed by Dr. Beach or by EPC during the prosecution of the EPC patent for the '294. So even though it was in the same field, the same technology, the same inventor, it was not cited during the prosecution of the

patent application.

So here we have the information on the Beach189 reference, and in the middle, we have the assignment information, and counsel for EPC did note that all of the individuals who you're going to hear from from EPC, they all came from the same company, International Rectifier. And, in fact, Dr. Beach, when he prepared the patent application for the Beach189 and obtained the patent, he assigned that to International Rectifier.

And when we put that in context, because we note that in the patent as claimed in claim one, it notes this concept of a compensated GaN layer, and so we would call the compensated GaN words -- we call them unicorn words, because a compensated GaN is not something that people normally do. They don't usually make the GaN layer more conductive.

And so here if we look at the elements of the claim, we have elements 1P through 1F, remember that figure one of the patent described each one of these elements specifically. So there is no dispute that these are already in the prior art. The only issue is this concept of compensated GaN.

So if we look at the Beach189 reference, we have that on the screen at slide 80, and on slide 80, figure four, element 25, that is a field plate 25, and that

is the field plate that we're looking at for this compensated GaN layer. Now, note that Dr. Beach, when he was working at International Rectifier, he specifically identified what the field plate 25 was in figure four, and as you can see, figure four has all the same elements of claim one of the '294. But also look at how he describes element 25. He describes field plate 25 as, quote: Highly electrically resistive material.

So this is exactly the same as what we see in the '294 patent, but not only does he explain field plate 25 as being resistive, note that he gives an example of what that would be, compensated GaN. The unicorn words of compensated GaN, the words we see nowhere else, hardly anywhere else, but yet we find it in Dr. Beach's prior art reference from when he was working at International Rectifier.

Now, Dr. Schubert, he will disagree and he will say, Well, I think that there is three reasons why the old Beach reference does not invalidate the new Beach patent, the '294, and he'll say, Number one, the compensated GaN in Beach189 is different from the compensated GaN that is in the '294 patent. But yet they use the same words, they use the same description. They're both resistive. They're both described as not conductive. So everything is exactly the same between the two, and we have found the unicorn

because this is what Beach189 is, it is the unicorn.

Now, the Federal Circuit has made clear that when you have an expert, such as Dr. Schubert, who is arguing that the plain words of the record or -- it's plainly inconsistent with the record and the terms, that should be disregarded, and that's what we have here.

Dr. Beach or Dr. Schubert also notes that claim 25 as an argument is not compensated because he just says, Well, it has to be conductive. I'm just looking at it and it looks conductive to me. Well, the patent application and the patent itself with the Beach189 reference specifically says otherwise.

The third argument that Dr. Schubert will present is that, Well, okay, even if I give you that you have compensated GaN in Beach189, I don't think Beach189 would work, and so it's nonfunctional, and so because it doesn't work, I don't think it's a good prior art reference.

Well, we know from the Federal Circuit that that's not the way you analyze invalidity. It doesn't -- you don't have to have a perfectly functioning -- as the Federal Circuit said in Massero, you don't have to have a perfectly functioning reference. You only have to have a disclosure, and here we have an exact disclosure of the same type of technology, with not only the technology

and -- the technology, but the same exact words, "compensated GaN." So once we map Beach189, we have a perfectly mapped invalidity chart for this patent.

So for the conclusion, Your Honor, of the '294 patent, before I get to the '508, we have an interesting dilemma that EPC has put itself in because of the arguments that it presents in its infringement case versus the arguments that it presents in its invalidity case or in its validity case. On the one hand, EPC argues that Innoscience's conductive p-GaN is semi-insulating and compensated for infringement.

But yet on the other hand, EPC argues that the Beach189's reference to compensated GaN is conductive. The exact opposite. So this fatal flip-flop, it means that at least the patent is not infringed or invalid, we would submit both.

With that, I'll move to the '508 patent, and the '508 patent, you did not hear much from counsel for EPC on this patent, but I will take you through some of the details because I think the reason they don't mention it is because noninfringement and invalidity are clear, and also DI is clear because they simply do not meet the claim.

So this patent deals with the etching of the layers in the fabrication process, and in the patent itself, it explains that it is directed to a GaN HEMT

device with a gate metal material and a dope GaN material as we show on the right side of the screen, slide 89.

So the gate is in purple, the dope GaN layer is in blue, and we circled in red this critical issue of alignment. So what does the patent say about alignment? Well, if we look in the abstract, we see a specific definition of being self-aligned. So during the creation of the gate and the GaN layer, what is self-align, and let's see exactly what it says. Now, what I'm looking at specifically here is self-aligned, and when it describes self-aligned, it says: The bottom of the gate metal, so here is the gate and this is the bottom: The bottom of the gate metal and the top of the gate compound have the same dimension. Well, here is the top of the gate, so you have the top -- the bottom of the gate metal and the top of the gate compound, so the gate compound is here, the gate metal is here, and so they are self-aligned, and so we put red circles around that to show that the self-alignment is there.

The '508 patent also explains how one obtains the self-alignment, and they do it by the four steps that you referenced earlier when we were discussing the issue of the '508, and that is it has a step of applying a photoresist, having the photoresist create a first etch, a second etch, and then resulting in a self-aligned process,

and that's figures 3B, 3BC, 3C, and 3C again, as shown through this process.

In order to make it very clear for the opening, I have a little animation where we have each step of elements 1F through 1I. 1F, you apply this blue photoresist at the top, so when 1F is referring to applying a photoresist, it's the blue photoresist at the top, so you put that onto the wafer.

After you do that, you etch away the gate contact layer that is below the photoresist. So if I go back, there is the gate contact layer. You etch below the photoresist. So that is element 1G.

Element 1H, you then etch away under the gate also with the photoresist, and so here you can see you do a second etching, so you have the photoresist, one mask, one photoresist mask, two etchings, and then finally you remove the photoresist, and that is element 1I. So these are the four steps that we'll be looking at.

Now, with respect to the overall claim, the claim is long and it has various sections, but the claim elements that we'll be mainly looking at are those four elements.

All of the other elements are admitted prior arts. It's specifically in the patent itself. It admits that these other elements are prior art. Counsel for EPC

says, Well, you know, there may be some admissions and so forth. Well, there is no admissions on the other elements. They have to prove those other elements, but those are still prior art and that's something that they will have to overcome in their proof of infringement, but if we look at the prior art device, we note that the prior art device that's described in the patent, it notes a different process, and here we have two masks that do not result in a self-aligned process. So first we have a first photoresist. Now, remember, what I have here is the textual description. What I have over here on the right, this is not a figure from the patent. This is something that I created in order to illustrate the text on the left.

And so what we have described in the specification as the prior art is the use of a first pattern photoresist, etching the gate layer, step two, removing this first mask, putting on a second photoresist mask, etching the GaN layer so you can see the second etching, and then resulting in the -- both the gate and the GaN layer being etched, but using two different masks, and so you can see two separate photo masks are used, and then also note that the two masks system has a wider gate link than the photoetched minimum critical distance, so that's resulting in a nonself-aligned process, so this is the prior art, and, in fact, if we look at all of the

embodiments for this etching process, we can see that they all result in alignment between the contact of the gate and the contact of the GaN layer. Now, other things may happen under that, but you saw the abstract, all it requires is that there be alignment at the point of contact between the gate and the GaN layer, which all of these embodiments illustrate.

Now, at the Markman hearing, you have some figures that were put up by EPC that shows different results from etching that take place after the portion of the claim that we're referring to, which is the etching of the gate and the p-GaN layer. These other -- this other step that the patent describes relates to an etching that results of the gate material. So these are figures of etching of the gate material. These are not what is at issue in the claims. They are disclosed in the patent, but they're not at issue in the elements that we're focusing on from the claims.

So what we have, therefore, is we have claim number one with its four elements and we have the prior art, and so we have a clear distinction between the elements of the claims and the prior art, and so the distinction that we make for purposes of the '508 patent is we make the distinction between the fact that the '508 patent has the self-aligned portions and the Innoscience

product is completely different because it uses this section over the top, and this section over the top, it is creating a wider p-GaN area than it is the gate area, and you're never going to have the same alignment that you have with the patent claim, and so --

CHIEF JUDGE CHENEY: Is the figure on the right public?

MR. LAVENUE: The figure on the right is -- it is, yeah, we need to put that on the confidential record. Thank you, Your Honor.

CHIEF JUDGE CHENEY: Okay. We're now in the confidential record.

(Whereupon, the hearing proceeded in confidential session.)

O P E N S E S S I O N

MR. LAVENUE: And I'll ask: Are there any confidential notes, okay, so I've confirmed there is nothing else from here forward. Thank you.

So for the invalidity argument, you'll again hear from our expert, Dr. Lebby, and Dr. Lebby will, again, be focusing on this point of novelty that's pointed to in the patent that distinguishes between the admitted prior art, which are elements 1P through 1D and 1J through 1R, and the alleged novelty elements, 1E through 1I, and Dr. Lebby will be explaining why these are satisfied, and the ground that he will be focusing on is ground one.

And ground one is a combination of Hikita Sheppard and Beach, but we'll note again that the main reference that we're using here for the elements at issue are another Dr. Beach reference, and this is another Beach reference from International Rectifier, when Dr. Beach was at International Rectifier, he was working on similar types of technology before he went to EPC, and this is another patent that is in that same line.

And here we have the Dr. Beach reference from Beach 629, and we have on the left figure 1D, and you can see in figure 1D we have the gate material 13, and then look at what Dr. Beach did in the Beach189 in figure 1E.

He did exactly what the '508 patent does, is he has a gate layer over a doped GaN layer with self-alignment.

That is exactly the same elements that they cite in the '508 patent for being the point of novelty, specifically disclosed in Dr. Beach's prior art reference. So we believe that this is also a very clear mapping that would address each and every one of these elements of the claim because once you take the elements that are admitted prior art, you combine that with Dr. Beach's prior art reference, you meet all the elements.

So with that I come to the end, Your Honor, and we have one more point to make, which is we have another fatal flip-flop, and that is on the one side you have EPC arguing for infringement of the claims on that one point that they say that the claims have no specific order for infringement and that's what they were advocating to you at the Markman, however, for the Beach624 reference, I did not get into this specifically, but you'll hear about it from Dr. Lebby, they argue that there is no specific order, and so for purposes of infringement they say -- I'm sorry, for invalidity they say there is a specific order. So for infringement they say there is no specific order. For validity they say there is a specific order.

So this is the fatal flip-flop that they have and this is a fatal flip-flop that shows the inconsistency

with their positions.

With that, Your Honor, I thank you for your time for the opening statement, and I appreciate, look forward to five days of trial.

CHIEF JUDGE CHENEY: Thank you, counsel.

Before we go on with the Staff's presentation, can I have slide 119 put up from Respondent's presentation? 118.

Is everyone using the same nomenclature for the elements of the '508 patent as are used on this slide, Complainant? In other words, do you have element 1A corresponding to the same part that Respondent calls 1A?

MR. LAVENUE: I'm seeing a shaking of the head no by the Complainant.

MR. ZEINEDDIN: Counsel is correct. We're not using the same nomenclature.

CHIEF JUDGE CHENEY: Okay.

Why don't y'all put some kind of translation in your brief so that I know the nomenclature that's used at trial in comparison to what your opponent used so that I can compare apples to apples.

One thing that sticks out to me is we have two 1Ps in this slide, one little p and one big P. So if you can just have your witness talk about the preamble, that will reduce confusion on both sides.

MR. LAVENUE: Will do, Your Honor.

MR. ZEINEDDIN: Thank you, Your Honor.

CHIEF JUDGE CHENEY: And while we're at this pause place, can we go to -- just so I understand as the evidence is presented, I heard Mr. Lavenue say that Respondents are asserting that the order of the '508 patent claims is required in Complainant's validity rebuttal, but not in Complainant's infringement theory.

Is that true or not true?

MR. ZEINEDDIN: That's not true, Your Honor.

CHIEF JUDGE CHENEY: Okay.

MR. ZEINEDDIN: Let me explain. There are a lot of steps in that '508 claim one. What was at issue at the Markman and what we're talking about is the order of steps for forming the gate. There are other parts that are also formed other than the gate. So the gate is typically formed first, right, in a self-aligned process. So I'm not clear exactly what counsel is talking about, but my understanding from our folks that are steeply involved in the '508 patent, that we are not making that contradiction.

CHIEF JUDGE CHENEY: Okay. We'll see how the evidence -- thank you.

MR. LAVENUE: Your Honor, we are in agreement on that issue.

CHIEF JUDGE CHENEY: Okay.

MR. LAVENUE: Because what we're saying is that we're saying for the gate formation steps, that we're saying that it does require an order. They're saying that the gate formation steps do not require an order, and then when I say that they're being inconsistent, we're referring to other steps that are not in the gate formation steps, which I believe counsel for EPC agrees. So the debate is where the formation steps have to be in order between us.

CHIEF JUDGE CHENEY: Okay. And you'd agree with Mr. Lavenue that the law doesn't require that -- never mind. We all know what the law requires. Let me just move on.

Mr. Winston, please proceed.

OPENING STATEMENT

MR. WINSTON: Good morning, Your Honor.

CHIEF JUDGE CHENEY: Good morning.

MR. WINSTON: I'd like to take a brief moment to summarize the Staff's positions and to highlight several of the key issues that will be addressed during the course of the evidentiary hearing.

As we've just heard from the private parties this investigation is about enhancement-mode gallium nitride transistors. There are two remaining patents at issue. The first patent that I will talk about is the '294

patent which addresses the problem of gate leakage during device conduction. Products at issue use a gate to control the flow of electricity between source and drain contacts. Because these are enhancement mode devices, current should not flow between the source and drain contacts unless sufficient voltage is applied to the gate contact.

Applying the voltage to the gate contact causes the two dimensional electron gas to form and enable the flow of electricity between the source and the drain. In an ideal enhancement-mode gallium nitride transistor, there would be no gate leakage, however, at the time of the invention, conventional gallium nitride enhancement mode transistors use conductive gate material that cause very high gate leakage. The '294 patent overcomes this problem by using a compensated gallium nitride layer as gate material instead of a conductive layer.

Using a compensated gallium nitride layer as gate material results in enhancement-mode gallium nitride transistors with lower gate leakage and gate capacitance.

The second patent is the -- I mean, it's the '508 patent which describes an improved method for fabricating enhancement-mode gallium nitride transistors. These transistors have gate contacts formed over doped gallium nitride layers. According to the patent, conventional fabrication techniques use separate masks to

pattern the gate material and the gate contact. The conventional two mask process led to wider gate links and thus increased manufacturing costs. The '508 patent solves this problem by using a single mask to etch both the gate contact and the doped gallium nitride gate material.

In short, the Staff expects the evidence to establish a violation of section 337 with respect to the '294 patent, but not with respect to the '508 patent. So that we can stay on the public record, I will avoid delving into any confidential business information.

I will, however, address several key issues that are relevant to the Commission's ultimate determination regarding infringement validity in domestic industry.

Let's begin with infringement. The evidence is expected to show infringement with respect to the '294 patent, but not with respect to the '508 patent. EPC contends that claims one through three of the '294 patent are infringed by the accused products. The central issue is whether the accused products have a compensated gallium nitride layer above the barrier layer as those claims require.

In this regard, EPC's expert, Dr. Schubert, is expected to testify that the electrical effects of the magnesium acceptors in the gallium nitride layers at issue

have been canceled by the hydrogen -- by hydrogen pacification and thus satisfies the limitation under any of the proposed constructions.

And with respect to the '508 patent, EPC contends that claim one of the patent is infringed by the accused products. EPC, however, is unable to show that the accused products perform the gate pattern in steps required by the asserted patent, the asserted claim, including the step of etching away the doped gallium nitride layer, except a portion of the doped gallium nitride layer beneath the gate contact as the claim requires.

Innoscience's expert, Dr. Doolittle, is expected to testify persuasively that these limitations are not met by the accused products.

With regard to validity, the Staff expects Innoscience will fail to show by clear and convincing evidence that any of the asserted claims is invalid.

For the '294 patent, none of the references discloses or suggests a compensated gallium nitride layer at an enhancement-mode transistor as required by those claims.

And for the '508 patent, none of the references discloses or suggests the device with a p-type gate structure and ohmic contacts that are made according to the claimed method of the '508 patent.

Next, turning to domestic industry, the Staff expects EPC to satisfy the domestic industry requirement of section 337 with respect to the '294 patent. For purposes of the technical prong, EPC relies upon its low voltage and high voltage gallium nitride enhancement-mode transistor products, which include approximately 250 different commercial products. EPC's expert, Dr. Schubert, is expected to persuasively testify that each limitation of the asserted claims are met by those products for the '294 patent, but not as to the '508 patent.

And with respect to the economic prong, EPC relies upon its domestic labor investments in research and development related to its DI products. EPC maintains facilities in El Segundo, Aliso Viejo, and San Jose, California where it conducts various research and development activities related to these products.

As will be explained by Dr. Vander Veen, these investments are both quantitatively and qualitatively significant in several different contexts.

After Dr. Vander Veen submitted his expert report on domestic industry, he realized that there were some additional investments that should have been included in his analysis. EPC submitted an untimely errata incorporating these additional investments, although EPC has been precluded from relying upon these additional

investments. It continues to rely upon the investments identified by the Staff in its prehearing brief and outlined in Dr. Vander Veen's expert report.

Accordingly, the expert is expected to show that EPC satisfies the domestic industry requirement of section 337.

Finally turning to remedy, if a violation is found, the Staff believes that a limited exclusion order and cease and desist orders are appropriate, and with respect to the bond, the Staff does not expect EPC to meet its burden. Because EPC and Innoscience are direct competitors, it should be possible to set bond based on price differentials. EPC, however, is not expected to proffer sufficient evidence to perform that analysis, nor is it expected to proffer evidence to establish a reasonable royalty rate.

If as is expected, EPC does not meet its burden, Staff respectfully submits the bond should be set at 0 percent of entered value.

I have nothing further at this time, Your Honor, unless you have any questions for me.

CHIEF JUDGE CHENEY: And, counsel, I just want to make sure I understand the Staff's position on the technical prong of the domestic industry requirement with respect to the '508 patent.

Do you contend that the Complainant has not met their burden?

MR. WINSTON: That's correct, Your Honor.

CHIEF JUDGE CHENEY: Thank you.

No other questions. Thank you, counsel.

MR. WINSTON: Thank you.

CHIEF JUDGE CHENEY: Okay. Let's begin with the presentation of evidence.

Is there a motion for the admission of unopposed exhibits?

MR. KOPSIDAS: Yes, Your Honor. Andrew Kopsidas from Blank Rome for Complainants.

We would -- we move that the exhibits listed in the parties' joint February 14, 2024 list of unopposed exhibits for which the parties request admission, we would move that those exhibits that are identified in that document be moved in.

I don't know if Your Honor prefers that I move only for Complainant's exhibits or all --

CHIEF JUDGE CHENEY: I'd prefer the motion to be unopposed for all exhibits. I hear no opposition to the motion. The exhibits will be admitted, and you'll please provide that list by email to the court reporter for insertion at this point in the record.

MR. KOPSIDAS: Yes, Your Honor.

CHIEF JUDGE CHENEY: Any other evidentiary matters before we call the first witness?

MR. ZEINEDDIN: Your Honor, may I?

CHIEF JUDGE CHENEY: Yes.

MR. ZEINEDDIN: Just a clarification.

CHIEF JUDGE CHENEY: Please turn on a microphone.

MR. ZEINEDDIN: Thank you, Your Honor.

Just as a clarification, our understanding of the ground rules regarding the exhibits and especially now with Dr. Lidow, who is going to be our first witness, 11.2 governing prehearing briefs says: Any contentions not set forth in detail in the prehearing brief shall be deemed abandoned or withdrawn. That we understand.

The question is as to whether the actual exhibits, that every single exhibit that will be used in the hearing, that should actually be specifically cited in the prehearing brief, as to that, the first paragraph, which is different than the third paragraph I just referenced, under 11.2 says: The prehearing brief shall include specific citations to legal authorities and record of evidence.

We understood, Your Honor, that all that means is that as we make our contentions and theories and what the evidence is supposed to show and will show in -- very

clear in the prehearing brief, we need only to cite sufficient exhibits to support that. We did not understand that the first paragraph says that: The prehearing brief shall include all specific citations to legal authorities and record evidence.

And so with Dr. Lidow, I'm going to be using several exhibits, not too much, and we have already complied with Your Honor's order and we have submitted the list to counsel for Respondents.

I do want to note that not all of the exhibits that -- on Dr. Lidow's list that I submitted and that I'll be using with Dr. Lidow were referenced in our prehearing brief. The contention which really -- he's going to tell the invention story and why, you know, he has an invention, the contention and the theories are in our prehearing brief. I do note and specifically I'm talking about portions of his inventor notebooks. These are notebooks that were produced at the very beginning of this case that are on the exhibit lists. We have long advised them that they're going to be on the exhibit lists. They are cited in their prehearing brief.

I also would like to note that they had the opportunity to depose Dr. Lidow knowing that he's the inventor, and so I intend to use two portions or more of specific portions of his inventor notebooks, and I just

wanted to advise Your Honor as to our understanding prior to today of your ground rules.

CHIEF JUDGE CHENEY: Okay. You have my ground rule about exhibit lists available. Does someone have that? Does it require the same response for the witness?

MR. ZEINEDDIN: Yes, Your Honor.

CHIEF JUDGE CHENEY: Can you read ground rule 12.2.1?

MR. ZEINEDDIN: So that's the exhibit list, Your Honor.

CHIEF JUDGE CHENEY: Yes, what does it say about sponsoring witnesses?

MR. ZEINEDDIN: So this is as to the sponsoring witnesses on the exhibit lists, Your Honor?

CHIEF JUDGE CHENEY: Yeah.

MR. ZEINEDDIN: As opposed to the prehearing brief?

CHIEF JUDGE CHENEY: Yeah, yep.

MR. ZEINEDDIN: The name of sponsoring witness in the status of receipt of the exhibit into evidence.

CHIEF JUDGE CHENEY: Okay. So is that the posthearing exhibit list rule?

MR. ZEINEDDIN: Prehearing list. That, Your Honor, as you note -- I don't mean to be sitting down. That, Your Honor, as you noted is the prehearing

disclosure.

CHIEF JUDGE CHENEY: Okay. And did you do that? Did you cite the sponsoring witness for each exhibit?

MR. ZEINEDDIN: Yes, Your Honor, because he's the inventor.

CHIEF JUDGE CHENEY: Okay.

MR. ZEINEDDIN: Moreover, these two exhibits are cited in their prehearing brief. He's the inventor. He's going to talk about his invention, and his oral testimony is not yet elicited, so it can't be in the prehearing brief.

CHIEF JUDGE CHENEY: Okay. We'll see if there is any objection that's raised. Let's call the first witness.

MR. ZEINEDDIN: Thank you, Your Honor.

CHIEF JUDGE CHENEY: Someone actually call the witness, please.

MR. ZEINEDDIN: Yes, Your Honor. I thought they were going to make an objection. Your Honor, Complainants would like to call Dr. Alex Lidow.

CHIEF JUDGE CHENEY: Dr. Lidow, please come to the witness stand. Remain standing while I administer the oath.

We'll wait for everyone to get settled.

MR. ZEINEDDIN: Thank you, Your Honor.

MR. LAVENUE: Please raise your right hand. Do you solemnly swear or affirm that the testimony that you're about to give in this matter will be the truth, the whole truth, and nothing but the truth under penalty of perjury?

THE WITNESS: I do.

CHIEF JUDGE CHENEY: Thank you.

Please take your seat.

(Witness sworn.)

CHIEF JUDGE CHENEY: Counsel, please proceed with your examination.

MR. ZEINEDDIN: Thank you, Your Honor.

A L E X A N D E R L I D O W,

Having been first duly sworn or affirmed on his oath, was thereafter examined and testified as follows:

DIRECT EXAMINATION

BY MR. ZEINEDDIN:

Q. Good morning Dr. Lidow.

A. Good morning.

Q. Would you kindly introduce yourself to Chief Judge Cheney and Staff.

A. I'm Alex Lidow. I'm a co-founder and Chief Executive of Efficient Power Conversion. It's nice to meet

you.

CHIEF JUDGE CHENEY: You also. Thanks for coming.

Q. Dr. Lidow, would you kindly describe your relationship with semiconductors and how it began.

A. So I was really born into semiconductors. My father and grandfather founded a company called International Rectifier in 1947 before I was born. So I grew up completely in the field of semiconductors. It was discussed at home. It was what we lived on.

Q. And, Dr. Lidow, can you tell us about your formal education after high school.

A. Yes. I was an undergraduate at California's Institute of Technology and I got a degree in applied physics, which at the time was the study of semiconductors mostly.

Then I went to graduate school at Stanford University and got a Ph.D. also in applied physics, which was a combination of materials science and semiconductors.

Q. Dr. Lidow, at CalTech, did you ever encounter or have a chance to meet the Richard Feynman?

A. Yes. He actually taught me quantum mechanics.

Q. How long did it take you to do your undergrad at CalTech?

A. I graduated in three years.

Q. Is that a typical thing or common thing at CalTech?

A. No, that was faster than normal, yes.

Q. And how long did it take you to obtain your Ph.D. in applied physics from Stanford University?

A. I got my Ph.D. in two years from Stanford.

Q. Two years after graduating from undergrad?

A. That's correct.

Q. Is that typical?

A. Well, it was probably a record at the time, yeah.

Q. I'm going to press you on this, so if you don't mind, does Stanford typically allow people to come in from undergraduate and two years later get a Ph.D.?

A. No. There is a residency requirement of three years, and so the fellowship that I had agreed to pay an additional year of tuition to make up for that.

Q. I am going to bother you again. I know you are uncomfortable talking about yourself, about the awards that you obtained, but let's talk about what you did in your Ph.D. at Stanford. Would you kindly tell the Court briefly what your thesis was about?

A. Yeah, my thesis was about a compound semiconductor gallium arsenide, and I worked in -- it's called the integrated circuit lab at Stanford University at

the time to do that.

Q. And what did you do, if anything, after you graduated from Stanford with a Ph.D.?

A. So I thought that it would be a great opportunity to use the techniques I'd learned at Stanford, which at the time that was the leading edge of integrated circuit technology in the world, and apply that to the field of power electronics, which was the primary field of International Rectifier, and power electronics really had not been modernized in many years, so I felt this would be a modernization technique.

Q. So how did you pursue that? Did you come to take a job after graduating with a Ph.D.?

A. Yeah, so I joined International Rectifier right after Ph.D., and I also encouraged a colleague of mine from graduate school to also join, and we had an idea of applying this integrated circuit technology to make a better power transistor and that eventually became something called the power MOSFET.

Q. Dr. Lidow, what was your position when you first started at IR, International Rectifier?

A. I was an R and D engineer.

Q. How high or low is that on the totem pole?

A. That was the lowest running. That was the mail room.

Q. So you mentioned that your father and grandfather started that company. Could you -- let's stick, if you don't mind, just for a brief moment, and could you please tell us how this company was started and how did it end up, where it was at the time that you started working there.

A. Yeah, so my father fled Nazi Germany just before the war. He had an electrical engineering degree. He came here penniless, and my grandfather and grandmother were trapped during the war and came over as survivors right after the war and together they founded International Rectifier.

Q. Around what year was that?

A. It was 1947.

Q. And by the time you started at International Rectifier, was it still owned by your father and grandfather?

A. No, it was a publicly traded company at that point.

Q. Okay. Going back to where I interrupted you, could you please tell us about the work that you wanted to do when you started at IR.

A. Well, my colleague, Tom Herman, and I wanted to apply these techniques that we'd learned in graduate school to make a better power transistor, and so we developed

something called a power MOSFET.

Q. Could you spell that for the record, please.

A. Yeah, so MOSFET is an acronym for metal oxide semiconductor field-effect transistor. So it would be all caps, M-O-S-F-E-T.

Q. So when you just said you developed the power MOSFET, what do you mean by that? Did you build a product or --

A. Yes. We built the power MOSFETs and they -- we got several patents on them, and it became, you know, quite a common component. I think everybody in this room probably has tens of thousands of these devices in all the things that they own.

Q. So you're saying that you and your colleague are the inventors of the power MOSFET, the fundamental power MOSFET?

A. Well, we held the basic patents, and those patents over the years we licensed to, I think, 25 other companies, basically the entire world to produce it as well.

Q. Did they generate any revenue for IR on these patents?

A. Yes, over the course of the life of the patents, the royalties that were, you know, received by International Rectifier were about $1 billion, a little

less, just a little less.

Q. 1 billion with a B?

A. With a B, yes.

Q. But International Rectifier started as a small company; right?

A. Yes.

Q. With your father and grandfather?

A. Yes.

Q. Did they have a lot of funding at the time that they started the company as they had come to this country?

A. No, no. My grandfather arrived penniless. My father was penniless a few years earlier when he arrived. So they pooled their funds. They found a couple of other investors and started International Rectifier.

Q. By the time you had joined it, had it grown?

A. Yes, it was a publicly traded company and the semiconductor portion -- they had other divisions. The semiconductor portion was about $30 million in revenue at the time.

Q. And these power MOSFETs that you patented and developed, did International Rectifier do anything with them?

A. Yeah, while I was there for almost 30 years, the -- International Rectifier was the largest producer of power MOSFETs in the world.

Q. So not only do they last in the industry and collected a billion?

A. That is right.

Q. They also were selling them?

A. That's correct.

Q. And International Rectify was able to grow from a small company to a bigger company and do that, but you had said they were in the semiconductor division. Did they have other divisions as well?

A. Yes, International Rectifier had a pharmaceutical division, a metals division, a distributor division, and eventually those all got sold off to just focus on semiconductors, particularly the power MOSFETs.

Q. Now, Dr. Lidow, what kind of material are these power MOSFET made of?

A. They're made in silicon.

Q. Not gallium nitride?

A. No.

Q. So did International Rectifier ever do anything or work in anything in the field of gallium nitride?

A. Yes, in 2003, we purchased a small company that was -- that one of the co-founders was Dr. Bob Beach, who is one of our co-inventors. We purchased that company and they were making gallium nitride diodes on top of sapphire, but just really in R and D mode, not selling them.

Q. So you said "we," but you told me that you started at International Rectifier in a public company as an engineer at the lowest rank?

A. Yes.

Q. What did you mean by "we"?

A. Well, "we" meaning the company.

Q. By then what was your position at International Rectifier?

A. I was the CEO for the last 12 years that I'd been at the company.

Q. So you rose through the ranks?

A. Yes.

Q. Okay. So going back to purchasing Bob Beach's company, what did you do with that technology at International Rectifier?

A. Well, since International Rectifier was in the advanced power semiconductor business, we decided to take that basic, you know, knowledge skill, whatever, and start making gallium nitride transistors, but also make them on top of a silicone layer instead of on top of sapphire.

Q. And what kind of devices were you building with that?

A. You know, this is very early on in the gallium nitride world. We decided this was a fantastic opportunity to make transistors, but the only transistors that at least

we knew how to make or thought could be made were depletion-mode devices, and I should explain that that means that they were normally on. They would normally conduct until you apply a control signal to turn them off.

Sometimes we call that D-mode, but that worked very well with International Rectifier, because in order to turn the device off to make it, if you will, safe to use, you needed another transistor, and lo and behold that could be a power MOSFET. That was the best way to do it. So this was an opportunity to combine International Rectifier's leading position in power MOSFETs with a new technology, like gallium nitride, and so a depletion-mode device worked just fine that way.

Q. So, in other words, you're saying that -- and I'm just try to understand -- you testified that the gallium nitride work at International Rectifier produced depletion-mode transistors?

A. That's correct. Depletion-mode gallium nitride on silicon, yes.

Q. And how much of that did International Rectifier sell?

A. I don't think they ever -- I'm not sure they ever sold any, but if they sold a few samples, it would be in the hundreds or maybe low thousands at most.

Q. Okay. How about power MOSFETs, how many of

those did they sell?

A. We were selling about a billion units every six weeks.

Q. Okay. Forgive me, so just to clarify what you said before, so was the thought that they were going to do that, the depletion-mode, and they pair them up with the MOSFET, but they never ended up doing it? Is that what you're talking about, or did they actually make a product with both of them together?

A. I don't think they made them together. They sold them separately, which, you know, is easy to do when you make so many MOSFETs.

Q. But they never made any sales with the gallium nitride part?

A. Certainly not significant sales, no.

Q. And that was during your tenureship at the IR?

A. Actually, they introduced their technology to the world two and a half years after I left.

Q. And so as far as you're aware, even after you left, did you monitor what they were doing in the gallium nitride space?

A. Yes, we did.

Q. And as far as you're aware, did they sell anything of significance in the gallium nitride space?

A. No.

Q. How did you leave International Rectifier?
A. Well, it was pretty unpleasant. I was pushed out by a couple of the Board of Directors, yeah.
Q. Now, you had said you were CEO there for 12 years?
A. Yes.
Q. How did IR do under your stewardship as a CEO?
A. Well, I think it did pretty well. When I joined the company, it was only $30 million. When I left, it was selling at about $1.4 billion per year. During my CEO reign of 12 years, it more than tripled.
Q. What became of International Rectifier?
A. Well, a few years after I left, it was sold to Infineon Corporation, a German company, for about $3 billion.
Q. What would you think the value of IR was at the time that you left it?
A. It was about $3 billion.
Q. Thank you, Dr. Lidow.
So what year -- do you remember the date that you left IR?
A. October 2, 2007.
Q. So what did you do after that?
A. Well, you know, I thought what's the best opportunity. I've spent my entire life in making, you

know, power semiconductors that were more -- made more efficient power conversion, that's what they're used for. That's where the energy savings comes from that was talked about earlier. So I thought, well, the best use of my skills, knowledge would be to try to keep going in that direction, and the best chance of doing that would be to use gallium nitride as a base material.

Q. Now, forgive me, so you were CEO at IR for 12 years?

A. Yes.

Q. Did you need to work after that?

A. I'm sorry, could you repeat the question?

Q. Did you need to work after that?

A. No, not really, no.

Q. You had enough money not to work?

A. I mean, I could have lived comfortably, yes.

Q. So why did you continue pursuing this area?

A. Well, first of all, I spent my whole life in it, not because I had to, but because I really loved it, and I just wanted to keep making it better and better. All my years at International Rectifier it was to make it better and better and better.

Q. Okay. Tell us what you did when you started EPC.

A. So first thing is I called up Dr. Bob Beach and

I called up Dr. Joe Cao, my other co-founder, and I asked if they wanted to join me, and both of them, you know, were willing to take, you know, a huge risk and join a company that hadn't even started, if you will. And so we had a small office and we started going right around the 1st of November I think.

Q. So you said you called Bob Beach, I believe you had testified that you had acquired this company while you were at IR?

A. Yes.

Q. And then the second person whom you called?

A. Joe Cao.

Q. Joe Cao?

A. Yes.

Q. How did you know Joe?

A. Well, I'd hired him out of college when he graduated Berkeley. So I knew him from, I'll say, when he was a kid, and that's how I knew him, so I've worked with him already for a long time.

Q. Where at?

A. At International Rectifier.

Q. And when you acquired Bob Beach's company, did Bob also go to IR?

A. Yes, he joined IR and was at IR when I left.

Q. Now, Dr. Cao, tell us, if you don't mind, about

his background and what made you interested in pursuing him and hiring him both at IR and EPC?

A. Yeah, I mean, first of all, he's quite a brilliant gentleman, but at International Rectifier, he distinguished himself because he'd worked both in power MOSFETs, designing processes for very high volume, very low cost, very high performance, and then he also -- in the last year or two, he went over to the gallium nitride activity to also start working on processes that might be used in high volume.

Q. That was while he was at IR?

A. That's correct.

Q. Do you know what his formal education is, his specialty?

A. Yes. He graduated Berkeley with a Ph.D. in materials science I believe it was, metallurgy.

Q. Metallurgy.

Now, Dr. Beach was -- what kind of field was he in with his Ph.D.?

A. Well, he graduated CalTech with a Ph.D. I believe it was in materials science or applied physics.

Q. It's kind of fuzzy at CalTech; right? Majors?

A. Yeah, the topic of your thesis is what's important.

Q. So what work did you all embark on over at EPC

when you first started?

A. Well, the origin of EPC, the thesis was that we would make devices out of gallium nitride that were both higher performance and lower cost than silicon MOSFETs. That was the device I helped develop 30 years prior, and I felt that we could do better than that, that that should be our thesis.

So, you know, Bob, Joe, and I, we're all sitting in an office not much bigger than this booth, and we brainstormed ways of doing that, but very quickly zeroed in on the idea that we needed to make a device that was most like a MOSFET and that means a natively enhancement mode device or something that's normally off.

Q. Can you explain, first of all, when you say "most like a MOSFET," in which way did you want to make it in silicon?

A. Well, we wanted to use gallium nitride. That was in our thesis to make it, but we wanted to replace MOSFETs.

Q. Why did you want to make it in gallium nitride as opposed to silicon?

A. You know, based on my background and certainly the two co-founders' background, we knew that we could make a much higher performance device in gallium nitride because of the attributes of a wide bandgap semiconductor.

And we also felt we could make it at lower cost because you can grow it as a thin layer on silicon and it has some very good properties for manufacturing.

Q. Okay. And when you're saying you wanted to make it normally off, can you please explain why were you doing that and what difference does it make, normally on, normally off?

A. So if you're conducting a lot of current, what you want is that if you -- you know, if it's normally off and you take away control from it, it turns itself off, that's pretty safe. If it's normally on, you've got to find a control signal and put it on there in order to turn it off, and so you have to add circuitry in a depletion-mode device to prevent it from being on when you don't want it. In a normally off device, you don't have to worry about that. You just need circuitry to decide when to turn it on, and in the world of power semiconductors, that is a very, very important thing.

Q. It's important for what?

A. Well, mostly for safety, but it also -- if you have to add circuitry to make sure this thing is fail safe, it adds cost, it adds size, and it slows the device down, so it reduces the performance.

Q. Wonderful. Thank you for explaining that.

So what did you do, you and your colleagues at

that point?

A. Well, we researched, you know, what was out there, and we, you know, found that we could use the UCLA nanolab for a nominal fee. We found another little company in Los Angeles that actually could grow gallium nitride on a piece of silicon, which was a fairly recent technology, and we went about trying to experiment with ways of doing an enhance-mode device and, you know, we just used the things that were already out in the literature to try to kind of understand how to make it.

Q. Okay. So you said you researched and you're looking at literature. What do you mean by that?

A. Well, there were certainly the people who had made enhancement-mode gallium nitride devices for a few years and they used a technique called, you know, growing a magnesium-doped GaN layer and activating that, and then that could make a transistor that way.

Q. Okay. So let me kind of go back, but specifically what kind of literature were you looking at?

A. Well, the literature that you'd find, you know, in journals, in, you know, journals and conference proceedings. I mean, went as far back as the Nobel Prize winning research by Nakagawa in the University of Nagoya.

Q. Would you kindly spell that for the record, by whom?

A. I think it was Nakagawa, N-A-K-A-G-A-W-A.

Q. Thank you.

So forgive me for asking this, but when I worked as an engineer, even people with graduate degrees were not running around reading conference proceedings and technical journal papers, but is this something you all did at IR as well even though you were working and you're not at a university?

A. Well, when I was CEO less so, but, you know, we encouraged all the people at International Rectifier to stay current with the technology, so they would go to conferences. They would certainly read the relevant literature in their field, and, you know, Bob and Joe were certainly quite knowledgeable and I had to catch up.

Q. Great.

And did you also look at things outside of these, you know, academic technical papers and journals and conference proceedings?

A. Well, yeah, certainly. We looked at something that might be in, you know, the trade journals and, you know, whatever was out there, you know, the business journals.

MR. ZEINEDDIN: So could we please put up CDX0007.

Slide one, please.

Q. So, Dr. Lidow, you testified that you had seen that people were making enhancement-mode -- I'm sorry.

MR. ZEINEDDIN: Seven, CD7.

Q. I believe it's the same page that you have. This is from my opening, which is fine.

MR. ZEINEDDIN: I trust Your Honor has and the Staff has, opposing counsel, the demonstrative for Dr. Lidow, which is CDT0007.1.

BY MR. ZEINEDDIN:

Q. So, Dr. Lidow, you have testified that people at the time that you started EPC were making enhancement-mode gallium nitride transistors that are normally off?

A. Yes.

Q. And forgive me, because -- did you say enhancement-mode or is it --

A. Yes.

Q. Okay. What does that mean?

A. Enhancement-mode would be the same thing as a normally off transistor.

Q. And you said -- what did you say that gate had in it?

A. The gate? I'm sorry?

Q. The gate for the enhancement-mode transistor that people were making?

A. They were making it with a magnesium-doped gallium nitride layer.

Q. Would you demonstrate to the Court where would that be on this drawing in front of you?

A. That would be the yellow region here. That would be the magnesium-doped gallium nitride gate with the gate metal on top of it.

CHIEF JUDGE CHENEY: For the record, this is CDX0007.1.

Please continue, counsel.

Oh, is there an objection?

MR. LAVENUE: Your Honor, I objected to the witness is going to continue to be in the form of an expert. If there are questions about the technology that the inventor developed, then that's appropriate, but turning the inventor into an expert to describe the technology is inappropriate under 402 at least. 702 at least. That's an improper of a layperson testimony as an expert.

CHIEF JUDGE CHENEY: Are you contending that this witness has no personal knowledge about this topic?

MR. LAVENUE: If the question is specifically about the invention or the technology of invention by question, that's fine, but if the witness is going to testify in an expert capacity, then that is not

appropriate.

CHIEF JUDGE CHENEY: And the difference between expert testimony and lay testimony is personal knowledge, right?

MR. LAVENUE: Correct.

CHIEF JUDGE CHENEY: So are you contending that this witness does not have personal knowledge of this subject matter?

MR. ZEINEDDIN: No, I am not, Your Honor.

CHIEF JUDGE CHENEY: Okay. Objection is overruled. Please continue.

MR. ZEINEDDIN: Thank you, Your Honor.

BY MR. ZEINEDDIN:

Q. So this is what you researched -- forgive me, this is what you researched. This is what you found as you testified. Where do you go next? What did you do?

A. I'm sorry, could you repeat that?

Q. Yes, this is what you researched and what you found in the literature, both in trade and the literature, and you found out about what people were doing. What did you do after that?

A. Well, we started working in this UCLA fab trying to reproduce the prior art, and also, you know, we had some ideas on how to improve upon it because of some weaknesses we saw in what the prior art was doing.

Q. Okay. So you say "prior art." I just want to clarify, did you know that you were going to have an invention on your hand really?

A. No, no. I've been around lawyers too much is what that means.

Q. So if you don't mind, if I may request, Your Honor, from the witness, just testify about the facts about what happened, if you don't mind.

Thank you, Dr. Lidow.

So you said you wanted to improve on what people were doing. Did you know of a specific device or thing that people were doing?

A. Well, yes, we actually saw a device that was made by Panasonic. I say saw. We read about a device that was made by Panasonic that used a magnesium-doped gallium nitride layer to create an enhancement-mode device that they called a gate injection transistor.

Q. And what did you think of that device?

A. Well, as the name implies, gate injection, it meant that it had a lot of leakage current in the gate, and so they turned that into a feature rather than a bug. And that was problematic because that would make it very difficult to control.

Q. So you said then you went about taking what was done before. You called it the prior art, but what was

done before, and then you wanted to improve it, and you had, did you say, any ideas on how to proceed?

A. Yeah. I mean, we had a couple of ideas. One of them was that maybe we put an insulating layer between the -- what's shown here as gate metal and the p-GaN gate layer and we'd pursue that. Also, you know, Dr. Cao had the idea that if we want to make this thing as small as possible, we should do something to make the gate as small as possible, and that was to use one mask and a self-aligned process to create the minimum dimension of the gate, because that was the biggest factor in determining the overall performance of the device.

Q. Thank you, Dr. Lidow.

Just for the record, when you said -- referred to the slide, we were still on slide number one in 007. You said you wanted to put an insulator and you said here. Could you point on that slide where you wanted to put the insulator?

A. Is this a touchscreen?

Q. Could you describe with your words --

A. Okay. So the -- the gate metal is the gray area. The gate p-GaN gate is the yellow area, and right between those we put an insulating layer.

Q. And why did you do that?

A. We wanted to block the leakage current. It was

as simple as that. You know, the Panasonic device required a lot of current. Well, it used a lot of current flowing through the gate and that was a disadvantage in applications.

Q. So just to be clear, what did you think the nature of that yellow part, that semiconductor part, the p-GaN part of the gate at the time?

A. Well, we thought it would be just like we read in the literature, just like Panasonic, it would be a conducting acceptor rich gate material.

Q. Can you expand on that just a little bit? What do you mean "in the literature"? Where did you read about that? How did you find that out?

A. Well, Panasonic talked about it certainly in their product information. We also saw that from, you know, some other literature, some patents that we'd read about, and so it was kind of a common knowledge I would say going back to this, you know, this original Nobel Prize winning work, that this is -- that what you want is an active p-GaN region.

Q. So we'll delve into that. What prize winning work are you referring to?

A. The work that I was talking about earlier by Nakamura at University of Nagoya.

Q. Dr. Nakagawa?

A. Sorry. Forgive me. Nakagawa, yes.
Q. Okay. I just wanted to be clear.
A. He needs to hear me, not you.
Q. You said award winning. What award?
A. It won the Nobel Prize.
Q. Okay. That one.

So explain to us what was revolutionary about his work in gallium nitride that you're specifically talking about.

A. Well, he's the one -- he was motivated to make a blue light-emitting diode. This is in the early '90s. They knew how to make green. They knew how to make red. They knew how to make yellow. They wanted blue, and then you could make TVs out of it and also white lights.

So that was a bit of a Holy Grail, and the issue was you needed to have a very active p-type region in a semiconductor that had a wide enough bandgap to emit blue light, and that was gallium nitride. So he tried adding magnesium impurities and found that in order to make it work like a p-type material, he had to cook it at a high temperature to eliminate some residual hydrogen that was left from the original growth process.

Q. So you said -- okay. So that was a mouthful. Let me kind of see -- parse it out. We start with gallium nitride; right?

A. Yes.
Q. That's a semiconductor?
A. Yes.
Q. And then you said he was putting what in it?
A. Magnesium.
Q. Okay. The magnesium. You said activate. What do you mean by that?
CHIEF JUDGE CHENEY: That's a big topic, so let's do that after lunch.
MR. ZEINEDDIN: Thank you, Your Honor.
CHIEF JUDGE CHENEY: We're now going to take a one-hour lunch break.
Dr. Lidow, please don't discuss your testimony with anyone during the break, and I noted that the demonstrative exhibits that the Complainant is using are in Box, but they're in like a floating top folder of Box. Going forward it would be helpful to put every exhibit for each witness in that witness' folder.
MR. ZEINEDDIN: Understood.
CHIEF JUDGE CHENEY: Both sides.
MR. ZEINEDDIN: Yes, Your Honor, we'll do that.
CHIEF JUDGE CHENEY: Thank you so much. We're off the record for one hour. See you at 1:30.
(A recess was taken at 12:31 p.m., after which the proceedings resumes at 1:30 p.m.)

CHIEF JUDGE CHENEY: Please take your seats.

We're back on the record. We're back on the record now in the 1366 investigation.

Before the lunch break, we were listening to the direct examination of Complainant's fact witness, Dr. Lidow, and there was a question pending, and we'll now resume that examination.

Mr. Zeineddin.

MR. ZEINEDDIN: Your Honor, if I may beg the indulging of the Court, may I repeat the question?

CHIEF JUDGE CHENEY: Yes.

MR. ZEINEDDIN: Thank you.

BY MR. ZEINEDDIN:

Q. Dr. Lidow, what did you mean by activating or activated when you were talking about the magnesium in the p-type GaN?

A. Well, what I meant was that certainly at the time we thought that what you had to do to make the p-GaN gate function or the p-GaN active was to, you know, cook off the hydrogen, and if you didn't do that, it wouldn't be active.

Q. And I believe you had mentioned that Dr. Nakagawa who later won a Nobel Prize for this work is the one who advised about activating?

A. Yeah. I think he first taught about passivated

magnesium-doped gallium nitride and how to activate it.

Q. Okay. If you don't mind, would you kindly explain to the Court why is the p-GaN passivated and what really activated is if you could with maybe simple terms to fully explain.

A. Well, certainly in this specific context, I don't know all the contexts, but what happens is if you grow gallium nitride in what's called a metal organic chemical vapored deposition system or MOCVD system, you put these gasses in there, and in order to have the nitrogen of the gallium nitride, you use ammonia, and it cracks off the nitrogen and the hydrogen is remaining.

Magnesium is an impurity and if you put it into gallium nitride, it tends to be an acceptor impurity except for the fact that the hydrogen will give it an electron, prefers an electron in which case it becomes inactive. So now I have a region that has magnesium in it, but it also has hydrogen that is feeding it what it wants. It wants an electron and then that's compensated.

Q. And, Dr. Lidow, where did that hydrogen come from?

A. Well, it came from the growth process. As I mentioned, the ammonia in the growth process as a surplus of hydrogen.

Q. I understand. Thank you.

So you're saying when you're making the p-GaN with doped magnesium, you're going to end up with hydrogen as a surplus and it's attached to the magnesium acceptor I believe you testified as part of that MOCVD.

Did I get that right?

A. Yes.

Q. Now, so when you do that, have you actually made a p-type --

(Clarification requested by the court reporter.)

Q. When you do that, have you actually achieved the step of making a P-type magnesium-doped material yet?

A. No, not yet.

Q. Why is that?

A. Well, because it needs to be activated. You need -- magnesium needs to act like an acceptor, which means that it wants an electron for it to be I'll say a traditional semiconductor p-type doping.

Q. Okay. So what I'm understanding is that the magnesium you say it wants an electron and the hydrogen gives it an electron?

A. That's correct.

Q. Which leaves it unwanting another electron; is that what you're saying?

A. That would be correct, inactive.

Q. I get it now.

So the acceptor inactive, active. It took me a while frankly studying up on this case to get this. So thank you for explaining it for the record.

So what did you do? So you cooked off the hydrogen?

A. In our earlier experiments, yeah, we kept cooking off the hydrogen as much as we could.

Q. Why?

A. Well, because that's what everybody told us to do. That was how it was done. That's where how Panasonic did it, how, you know, everybody had been doing it at that time.

Q. And now you're specifically talking about these normally off enhancement mode?

A. Yes, goal number one was normally off.

Q. Okay. Let's go to the other type, the type that IR was trying to make.

What was that again depletion?

A. It was depletion-mode or normally on device.

Q. Did you need to activate the p-GaN there?

A. There was no p-GaN involved.

Q. What's in the gate then?

A. It was just gate metal.

Q. I get it. Okay.

So for normally on it's just gate metal?

A. That's one of the ways of doing it. There are other ways, but that was the way International Rectifier did it.

Q. Did they ever -- did anybody ever use semiconductor that they needed to activate in depletion-mode to your knowledge just as a fact witness?

A. I don't know of any case, no.

Q. Okay.

So you said you activated it as much as you can and you said you did the experiments. Tell us about the experiments. I think that's the first time we hear about experiments today.

A. So we did a bunch of experiments at UCLA in their nanolab. None of them worked. I convinced a person in Taiwan who owned a silicon foundry to let us use his foundry because it had more sophisticated manufacturing-oriented equipment. The foundry's name was Episil. And so beginning in the January, February 2008 time frame, Bob, Joe, and I would go out to Taiwan and start working in that foundry to experiment with making devices.

Q. Thank you.

So your experimenting -- I just want to be clear. You said you were trying a couple of things I think

you testified. You said one of them was to put an insulator between the gray part, the metal and the yellow part semiconductor p-GaN in the gate?

A. Yes.

Q. Is there anything else?

A. Yeah. I think I mentioned earlier that, you know, Dr. Cao had the idea that in order to maximize the performance and cost advantage of this device that we should have the gate be as small as possible and to make it as small as possible you want to have the minimum, minimum feature size that a factory can make and to do that, you should use a self-aligned process. So we could align all the different layers that make up the gate, in this case metal in this p-GaN layer with one mask layer and that would be minimum.

Q. Thank you, Dr. Lidow.

MR. ZEINEDDIN: Could we please put up again CDX7.1.

Q. So, Dr. Lidow, what, if anything -- using this graphic here, can you illustrate what, if anything, you did on that front on the front of the self-alignment of the gate back, back in the time frame you were talking about.

A. Yeah. So what we did was we would use one photo mask that would define the gate metal that would be over the gate metal and over the p-GaN, which at this point

were complete layers covering the entire surface that we're working on.

Then you put the photoresist and you define it over -- well, at the minimum feature that you can. This time it's on top of the gate metal and then you etch it. You etch the gate metal and then you can etch the p-GaN regions without using a second photo mask so that they're as small as possible and well aligned to each other.

Q. Now, up to that point, I mean, self-alignment was a known process; right?

A. Yes.

Q. So you were doing something -- you're not experimenting on that. You're doing something that everybody knows how to do?

A. The concept was well-known, but there were -- there are many things that we had to overcome to make it possible in an enhancement mode device.

Q. Okay. Could you please explain that to the Court.

A. Well, so, first of all, we knew we needed, you know, to have a gate metal on top of the gate p-GaN. That was a known thing, but we also needed to make connections to the device for the drain in the source, and if you're going to do a self-aligned gate, it has to be the first step that you do because you have these sheets of material,

p-GaN metal, and if you want self-alignment, you have to etch them first.

So if you do that, that means that everything in this stack has to be able to survive everything else that you're going to do, and one of the difficulties was that this gate would have to survive the high temperatures that were needed later on to form the source and drain connections.

So number one, most metals would melt under those higher temperature conditions that were needed. So we had to pick a certain variety of metals that would withstand this high temperature and not interact with the gallium nitride, and then second, you know, that whole thing would have to be protected so that it didn't all fall apart and melt during the later stages where we start forming the drain and the source electrodes.

Q. So what, if anything, did you all experiment with to protect it?

A. So we -- I mean, we tried different things. We tried plasma enhanced silicon nitrite because it was available in UCLA and it all peeled off during the temperature steps, and then we tried low pressure CVD silicon nitride to coat the entire device with it and that was good because it stuck during the rest of the processing.

Q. Okay. So let's pause for a second and talk about the time frame.

You had started EPC when?

A. I think it was the first day of November 2007.

Q. Okay. Then I believe you testified you started at UCLA. You wanted to find some place else better and you went to Episil. And when was that?

A. January, February of 2008.

Q. Okay. So a few months after.

Let me ask you this: At that time when you said you were doing the experiments, did you -- where did you start doing these?

A. Well, we started in UCLA with the self-aligning gate, but we couldn't really finish the device because the equipment wasn't capable.

Q. So what happened when you went to Episil and started experimenting there?

A. Well, we started building stuff with their equipment and, you know, just to outline it, what you do is you start with a silicon wafer on those things that has epitaxial layers grown on it and then you usually take several of those, you put them together into what we call a lot and then you put the lot and process it all at one time.

Now, the different wafers may have different

variables in them, different growth of EPI and maybe even this lot you'll split and do different things with it, but normally you try to process it all at the same time so that you can see what difference the variables make to your end result.

Q. I understand.

Is this -- doing this kind of trying out different things and seeing what works and I guess is that something that you guys had done before? Is this something that -- the process of how you worked?

A. Yeah, I mean, that's -- I think that's a relatively standard engineering practice. We call those things designs of experiment, DOEs.

Q. Okay. So let me ask you this: So now you're at Episil. So I guess you did the lot?

A. Yes, lot number one.

Q. Lot number one. Okay.

And lot number one, you talked about putting in an insulator between that gray metal that's depicted in demonstrative 7.1 and then the yellow part and you said you also coded the device. Could you describe using the demonstrative where you put the device silicon nitride?

A. Yeah. So if you can imagine this demonstrative without the drain and the source electrodes. So right after you've formed the gate, which would be a self-aligned

gate, you would then coat it with the silicon nitrite layer the entire thing and then you'd come along and you'd make openings for the drain and the source and then you'd put your source and drain metal into those openings and then you would heat them up to a high temperature in order to make the metal blend in with the underlying gallium nitride or melt in there.

Q. Okay. So you tried that in lot one?

A. Yes, in lot one we did all that including with the insulator in the gate, self-aligned gate, everything we wanted.

Q. How did that work out for you?

A. It almost worked. It was, you know, tantalizingly good in that the device is turned on, but then they turn themselves off. So you go on, but you go off. So we didn't really know what to make of that at that point.

Q. Okay. So what did you do next?

A. We tried it again on lot two. Pretty much the same thing just to see if we were maybe unlucky on the first run and it pretty much gave the exact same result.

Q. What did you do next?

A. Tried it on lot three and got the same result.

Q. Okay. Timewise now how far along are you from the day you started EPC?

A. Well, I think maybe, you know, we're now in March or April of 2008, so that would be what? Five months since the start of EPC.

Q. Now, when you started EPC, how did you raise -- did you have to raise any money to start it?

A. Well, yes. I had to raise money to, you know, pay for salaries of Bob and Joe and buy some equipment and travel and I had to borrow that money from my family.

Q. At this time, was it only you, Dr. Beach, Bob Beach and Joe, Dr. Joe Cao at EPC?

A. By the time we were going to Episil to run wafers, we also had two new members on our staff, Dr. Guan Yuan Zhao, which I'm sure we could spell if I knew exactly how.

Q. Okay.

A. Because we called him GZ.

Q. Okay.

A. And GZ, by the way, came from that famous group at the University of Nagawa. That was the group where he got his Ph.D. and we also had Alana Nakata who I had worked with for many years at International Rectifier. I also hired her out of school.

Q. And were all of them people that you had worked with also at the IR?

A. Yes. GZ less so, but the others I'd worked

with for many years.

Q. Okay. So how did it feel? And things are failing?

A. Yeah, I mean, it's terrifying. It's terrifying. You're worried about running out of money. At this point, we're trying things that aren't working, but, you know, they look like we don't know why they don't work. They should work, and so it's quite scary because every time you run wafers, it costs a lot money.

Q. So what did you do next?

A. We ran lot number four.

Q. Okay.

A. And on a lot number four, we varied the insulator thickness and we actually even did one a couple of wafers I think with the insulator removed completely or let's say not deposited, so zero thickness insulator.

Q. And how did that work out?

A. So, you know, at first we looked at the, you know, tested the wafer that had no insulator and it didn't look very good, but we kept looking and looking and looking and found in a small corner of that wafer some devices seemed to behave what I'll say maybe is irrationally or abnormally or we didn't understand them in that they had a combination of -- well, they were able to turn on and stay on and they were able to turn off and stay off and they

didn't have -- they had very, very low leakage current going through the gate.

And when I say low, what was surprising was, you know, these devices like Panasonic was making, they would have 100 milliamps for every millimeter of gate and these devices had about a microamp per millimeter of gate. So, you know, that was like a hundred thousand times better.

Q. Okay. So going from a hundred thousand to what?

A. One.

Q. To one. Okay.

That was lot four?

A. That was the corner of one wafer in lot four.

Q. Was there anything different about that corner in one wafer in lot four?

A. Well, it didn't have any silicon nitride. It had, you know, all the other things, but it was processed like, you know, all the wafers before except for that missing silicon nitride layer.

Q. Okay. So you said it didn't have any silicon nitride. I understood you had mentioned silicon nitride in a couple of places before.

Would you kindly explain to the Court what exactly it had and what exactly it didn't have -- didn't

have?

A. So this -- you know, the entire wafer had the same thing. It's just one corner that seemed to work and the entire wafer had -- it had the self-aligned gate. It had the silicon nitride on top and it had, you know, a few steps. Right after we grew the EPI, we had a step that was activating the p-GaN or we wanted to activate the p-GaN and then it had the silicon nitride protection layer over the whole thing and, you know source and drain contacts and it actually made a transistor, so it was a completed device.

Q. And you said this one did not have the silicon nitride. I thought you just said it did have the silicon nitride on it?

A. No, no. I was talking about the silicon nitride that coats the entire wafer. The later silicon nitride, it did not have the insulating layer between the gate and the p-GaN which happened to also have been made with silicon nitride.

Q. I get it.

When you're using that silicon nitride insulating layer between the gate metal and the yellow part, the semiconductor, how thick was that?

A. I believe we tried 200 angstroms and 100 angstroms and maybe other thicknesses as well.

Q. Okay. And you were trying to insulate the gate

metal I believe you testified?

A. Yeah. We tried to get rid of the leakage current.

Q. Okay. So what did you do next?

A. Well, like all good engineers, we tried to reproduce a good result.

Q. Okay.

A. So that was lot five.

Q. Okay. And what did you do there?

A. Well, you know, first of all, not giving up on the silicon nitride insulating layer between the metal and the p-GaN, we had wafers with those too and then we also had several wafers without any insulator between the gate melting and the p-GaN.

Q. Okay. And how did that work out?

A. And that worked. We had, you know, quite a bit more success. The wafers that did not have that insulating layer worked pretty well, surprisingly well.

Q. What about the ones that did have insulator?

A. They didn't work. So that was the end of that.

Q. Did not work?

A. Did not work.

Q. So you're saying that was the end of that. That's when you decided you're not doing that again?

A. We decided finally to put to rest this idea of

an insulator in the gate.

Q. What did you do next?

A. Well, so we did lot six and then we needed to do some process development, so we did a lot seven, which was just for process development and did not produce any devices at all and then we did lot eight.

So we then varied other things in the various lots and at the end of lot five, six, and eight we had quite a few variables, and so it was at that time that, you know, I sat down and did an analysis of what we had, you know, try to get all this information, put it in one spot and see if we can make sense of it because at that time we didn't really understand what was going on.

MR. ZEINEDDIN: Your Honor, with your indulgence, may I instruct the witness just quickly?

Q. Would you allow me to ask you a couple of questions because we're not really allowed just to have you up there and talk all the time.

A. Okay.

Q. Okay. So you said you did lot five. That worked. You were happy, but then you said you did lot six if I believe your -- that's what you said and then lot eight. Why did you keep making these lots?

A. So we wanted to explore the variables, the variables of, you know, how much -- you know, variables of

growth temperatures, variables of thickness of the gate layers and, gosh, I'm sure there were some other variables in there, but we wanted to sort of understand what made this thing move one way or the other.

Q. So to be clear, by lot five you already think you have something you can replicate and you can -- you know, it's kind of nice?

A. Yes.

Q. But you kept doing more experiments because you wanted to?

A. Well, we wanted to, first of all, see were we on the edge? Would it not work if we moved something, you know, a few degrees and we wanted to understand could we make it even better? So we wanted to try different variables.

Q. Thank you.

And before I interrupted you with my question, you were saying you just sat there, you sat down and you were analyzing the results?

A. Yes.

Q. Now, where did you do that physically?

A. Well, physically this was the back in our El Segundo, California office where we all clustered in a small room, and so I took all of the information that we had at that time and put it all into an analysis report

that was I think part of my lab notebook as well.

Q. And at that time, did you have an office? Where was Episil?

A. Episil was in Taiwan. Still is.

Q. Where was your office?

A. El Segundo, California.

Q. So when you go to Taiwan, you just go there to do the experiments?

A. Yeah. We would go there. Usually one of us was always there and then, you know, we would rotate around and come back to El Segundo, and at this point in time, we were actually all in El Segundo trying to, you know, figure out what we had done.

Q. So tell us more about that analysis, if you don't mind.

A. Well, I think we have an image of some of that.

Q. Sure.

A. Maybe we could show that.

Q. I'll pull something up to see if that's what you have in mind, but do you recall the date?

A. The date would be September 22, 2008.

Q. Okay.

A. And I think there is a part of my notebook that says analysis of lot six and eight although it included information from lot five as well.

MR. ZEINEDDIN: Could we, please, Mr. Ortega, pull up CX0103C at 200.

Q. Dr. Lidow, if you'd also like to refer to this in your binder in front of you, that would be at tab two, if you'd like.

Dr. Lidow, is this thing in front of you right now, CX0103C-200, is this something you're familiar with.

A. Yes. That's the cover page to this analysis.

Q. So that's the conference page and that's dated September 22, 2008, I believe?

A. Yes.

Q. Okay. Then in that case, what would you like to do now? Would you like to talk about it?

A. I would like to talk about it actually, and I think it's actually marked confidential information, but I don't feel a problem revealing it today.

Q. If you don't mind, I will ask you that about every page just to make sure that every page that we're putting up is something that you're okay with the public to see.

So this one you're fine?

A. This page is great.

Q. How about the next one?

A. Well, let's go to the next one.

Q. Okay.

A. All right. So the next page --
Q. That one is fine for the public to see?
A. This one is fine for the public to see as well.
Q. Thank you, Dr. Lidow.
A. And with glasses it will be fine for me to see it too.

So this is a table that shows the various variables that we used in this -- in these two lots, and so this was what we would call a design of experiments or DOE and maybe I can go from left-hand column all the way over to describe what it is.

So where it says wafers, that first column on the left, those are the number -- the individual numbers of the individual wafers, and then it says EPI material information and it shows you all the variables that we were doing to grow the final p-GaN layer, and you'll see different temperatures and some different thicknesses there as well.

And then if you move to the next column -- so at this point you'll have a wafer that has on its top surface is p-GaN and then we took these wafers and then we would do what we call here p-GaN activation, and that was that we would take them into a rapid thermal annealing system or RTA system and as it says below, we would cook them at 875 degrees for 60 seconds.

Q. May I, Dr. Lidow? I'm actually supposed to ask you questions.

Thank you, Dr. Lidow.

So this column, the p-GaN activation you say that cooks it at 875 degrees for 60 seconds?

A. Yes.

Q. And why were you doing that part?

A. We wanted to activate the magnesium.

Q. Why?

A. Because that's what we thought we needed to do. That's what everybody had taught us we needed to do at this point.

Q. So based upon what you were saying before, you were activating the magnesium why?

A. Well, we were trying to cook off the hydrogen and make it an active acceptor.

Q. Make what an active acceptor?

A. Magnesium.

Q. Understood. Thank you.

What is the next column then showing?

A. So the next column is saying gate silicon nitride, that was that insulating layer that we tried and tried and tried to make work and by this time we said no. So it says none.

Q. I see.

So when that column says none, that means this step is not followed?

A. Yes.

Q. And that's not followed for all -- is it not followed for everything on that page?

A. Everything on this page has no insulating layer.

Q. Okay. What's the next one?

A. Well, so the wafers then would go through a gate metal step where we would deposit titanium nitride. It's not shown here because, I mean, it was just a normal step and then you would go through --

Q. May I ask a question? Forgive me. Okay.

So you cook off the hydrogen -- before I say that, I don't want to leave, these columns, why are they arranged from left to right?

A. Normally they follow the process the wafers went through.

Q. Okay. So the p-GaN activation happens first before you put on the gate metal?

A. That's correct.

Q. Meaning you get rid of the hydrogen and activate the magnesium before you put on the metal?

A. That was our thinking, yes.

Q. Okay. So now we are in -- I believe just to

orient you I think you were talking about the column entitled gate SF6 etch; am I correct?

A. So the inner -- the steps in between was we deposit the titanium nitride. We put a photo mask. This is the single photo mask from the '508 patent and we defined where we want gate. And then we use one machine here, it's called P5000. That's the name of a machine and we use a fluoride gas, SF6 to etch the titanium nitride layer.

Q. That's the metal part of the gate?

A. That's the metal part of the gate, yes.

Q. Okay. What's the next column?

A. The next one says gate CL or chlorine etch and the etch chemistry for gallium nitride involves chlorine and it's done in a Samco machine. So that's why it says Samco. So then you etch the p-GaN layer.

Q. Okay. At this point what have you formed?

A. You formed the gate.

Q. Okay. How about the other parts of this transistor?

A. Well, everywhere else it's just, you know, flat desert at this point.

Q. Okay.

A. And then the next step would be to protect it all with this silicon nitride coating.

Q. And how did you do that?

A. Well, so it's labeled here field silicon nitride Si three and four, and the machine is a low pressure chemical vapor deposition system, LPCVD and that actually operates a high temperature, but you push the wafers in at a lower temperature.

So here we're talking about pushing the wafers into the furnace tube at 400 degrees C, and if you'd like, I can describe what happens in the process after that.

Q. I would be grateful. Thank you. Please go ahead.

A. So then they get pushed into the furnace, this tube that can heat up and a vacuum gets established in that tube and then various gasses get pushed in there while the wafers heat up and they heat up to around 770 degrees centigrade and then various gasses including an ammonia gas blow over the wafers to grow this silicon nitride layer and then after that it cools down. You pull it out and then you go through the other steps in the process.

Q. Now, at this point, how long is that last column, the field SI3N4 that grows the coating of the silicon nitride?

A. It's -- it's --

Q. How long does it take?

A. It's several hours.

Q. And how many hours is it operating at the highest temperature?

A. I think about two hours.

Q. And what is the highest temperature to the extent that you know?

A. 770 degrees.

Q. Okay. So what do you do next?

A. Well, so -- and the reason we don't even show it here is because all the other steps are very standard steps for any silicon foundry. So they are just done like all the other wafers in that factory, and that involves making openings, contact opens they're called for the source and the drain, depositing source, it's one metal layer that you then define into source and drain regions, etch it and then you're virtually finished at that point with the device.

Q. Okay. Thank you, Dr. Lidow.

So I believe you mentioned this was -- you were doing analysis on lot five, six, and eight, but this only says lot six/eight?

A. Yes. I think in some of the later analyses we show wafers that we brought in from the data from lot five as well. So maybe if we go to the next page.

Q. Is that confidential? Do we need to seal the courtroom?

A. No.

Q. Okay. Could we, please, go to next page, please, 202.

What is this? Let me ask a question.

Dr. Lidow, what does this page show as far as your analysis back in September 2008?

A. So, as I mentioned, we were trying various -- varying various parameters and in this one it's labeled growth temperature at the top, and what we were doing was looking at the effect of different temperatures at which we grew the p-GaN layer wondering, you know, did that have an impact on, you know, on the performance or the activation.

The graph itself is called a transfer curve in, you know, normal language for device people and what you're looking at is the drain current is plotted on the vertical access, and that is the current you put a voltage across the drain and source and then you apply a gate voltage on the controller gate electrode, and it turns the device on conducted current and then keeping this drain voltage fixed, you vary the gray volt step-by-step-by-step and you mention how much drain current is flowing through this transistor. Then that's a transfer curve.

Q. Dr. Lidow, if you don't mind, let me take you back to your demonstrative, the diagram that shows the basic transistor if you don't mind, which for the record is

CDX7.1.

Can you explain to us exactly here what is it that you're varying and what is it that you're measuring with words perhaps describing that using the colors as a reference.

A. Yes. So if you notice, you have a source and a drain electrode, and there is a little squiggle off the source electrode, which basically is saying it's connected to ground or earth potential. Then you see the drain terminal and there is a plus, so you apply a positive voltage on that, just a couple of volts if you want to measure this current and then we applied on the gate metal several different gate voltages starting at -- probably starting at even a negative voltage, but again, up to more and more positive voltages and with a current meter in series with the drain power supply you measure how much current is flowing from the drain to the -- well, it's actually from the source to the drain because I think Ben Franklin thought charges were positive, but the electrons are going from drain to source.

Q. So, Dr. Lidow, you said the current is flowing. Where exactly is the current flowing in here?

A. So --

Q. In which region?

A. Yeah, so it would be at the interface of the

dark blue and light blue regions.

Q. Why do you say it's the interface?

A. It's at that interface where the two dimension electron gas lives.

Q. Okay. I understand. Thank you.

But, okay, let's go back to the prior exhibit that we were looking at. CX103C. I believe we're on page 202.

I interrupted you. So having described what you were measuring and where you were measuring it, what did that mean to you?

A. So, you know, we plotted on one graph these transfer curves from devices that had been grown at various temperatures from 960 to 1050 degrees centigrade and we saw no difference.

Q. What did that mean?

A. Well, it meant that the -- and I think it's written down at the bottom. There is not any systematic impact on acceptor activation as a function of grow temperature.

Q. Just to be clear, these words at the bottom that you see I believe -- I need to put on my glasses, but I believe they're in a different color. They're in red. Are these words part of the original document that you made back in September 22, 2008?

A. Yes, they are. I put those words in myself.
Q. Okay. I guess that's a conclusion from this?
A. That's a conclusion of what this data shows.
Q. What does it mean? Could you explain it to me in a simple --
A. Well, it means that the activation of the magnesium was not impacted by the growth conditions.
Q. Did that tell you anything?
A. It told us one thing, that it's not affected by. So that's important. You know, you've got to know all the things that are impactful and things that aren't impactful. We expected an impact and were surprised that there wasn't none.
Q. Why were you expecting an impact?
A. Because the higher the temperature, the more you cook off the hydrogen supposedly.
Q. I understand. Okay.
What would you like to do next with this analysis?
A. Let's go to the next page.
Q. Is that okay with the public?
A. Yes.
Q. Okay. Thank you.
MR. ZEINEDDIN: For the record, we are on CX103C203.

Q. What, if anything, did you note down here?

A. So once again, we're looking at grow temperature and we're looking at other characteristics as it says at the top VDS or drain source voltage versus growth temperature, and so we plotted the leakage current from the drain to the source, which is just another important characteristic versus that growth temperature and as it says down at the bottom there is some effect on the leakage current from drain source.

Again, that's a very different leakage current because these are very, very low leakage currents. So there were some decrease in that leakage up to 1,025 degrees, but after that the leakage increased a little bit.

Q. For me all I see is some beautiful kind of colored curve. What does that mean, if you can describe it to us?

A. So, I mean, what it means is we didn't ruin the devices. That's really all it meant is we were worried that it would ruin the devices. In other characteristics in this case, drain source voltage characteristics, you'll notice the horizontal access on these goes up to a hundred volts. We were trying to achieve 100-volt devices.

So we had to verify that we still had hundred volt devices, and we wanted to make sure that all the growth conditions still produced within range an acceptable

result, which they did and there is an observation at the bottom, is there a peak to p-GaN activation at 1025C?

Q. So why is there a question mark?

A. Because it's a very weak difference between all these lines. So it may very well be just, you know, wafer variations that caused it rather than activation. It wasn't a clear signal with a lot of noise on it.

Q. Okay. So I just told you I believe you just testified that you haven't ruined the device.

Did you do any further analysis?

A. Yes, we did, and I think that's on the next page.

Q. And is that page confidential or can we show it?

A. Please show it.

Q. It is confidential, but you're choosing to show it. Is that --

A. It's not confidential. Please show it.

Q. It's not confidential now, but before it was confidential?

A. Well, when you say before it was confidential, at that time.

Q. Okay.

A. In 2008. It's not today.

Q. Okay. So let's go to 204, please.

And what does that page show?

A. So the top tells you what variable we were looking at and that's p-GaN thickness, the thickness of the p-GaN layer and, you know, this was an incredible a-ha moment when we did this analysis because it really showed us that something was going on here that was completely different than what we expected.

And so, again, I'm looking at transfer curves, the drain current is on the vertical access and the gate voltage is on the horizontal access, and we're now looking at the effect of the gate p-GaN thickness and the blue lines are the devices at 300 angstroms of p-GaN gate grown. The yellow lines are 600 angstroms, and the green lines are 1,000 angstroms of p-GaN grown, and if you'll notice they have significantly different slopes. They're clustered very differently.

CHIEF JUDGE CHENEY: Let's go off the record for just a moment.

(Whereupon, a discussion is held off the record.)

CHIEF JUDGE CHENEY: Back on the record after taking a brief recess to deal with some technical issues.

Please continue, counsel.

BY MR. ZEINEDDIN:

Q. So, Dr. Lidow, let's go back again to your

demonstrative slide, which is CDX71, what thickness were you using? This kind of just outline simple diagram? What thickness were you varying?

A. The yellow region. The yellow region on this one we were varying 300 angstroms, 600 angstroms, and 1,000 angstroms.

Q. So I think you had testified before that's the P --

A. That's the p-GaN region.

Q. Of the gate?

A. Of the gate, yes.

Q. Okay. Let's go back again to CX103C at 204. Okay.

So you have here three different thicknesses and you're noticing you said you had different characteristics?

A. Yes. So, you know, the different slope was a big surprise because it told us as it says at the bottom the conclusion was that the p-GaN is fully depleted.

Now, the reason we understood that from these graphs is that if you or for one, the device is acting as if between the gate metal and the two-dimension electron gas, it's acting as if there is an insulator or a fully depleted region.

Q. Okay.

A. Yeah.

Q. What's acting as an insulator, if you don't mind?

A. Well, what this is saying is the whole region below the gate metal and down all the way to the two dimension electron gas, all that's acting like it's insulating.

Q. Let's go back, let's go back to the demonstrative CDX007.1.

Could you please describe using this demonstrative what part are you talking about that you think is insulating?

A. So if you drill a line down at the very bottom of the gate metal, so at the top of the p-GaN layer and then another line between the light blue and the dark blue, that region was not conducting.

Q. So when you say that region was not conducting, are you talking about the whole region or just the dark blue line?

A. Well, clearly the whole region was not conducting because it varied as we made the yellow thicker and thinner.

Q. So it was the yellow for the record as well as the dark blue layer?

A. Yes.

Q. Why did you think that the yellow part was also not conducting?

A. Because it's the only explanation that fit that when you change the variable being the thickness of that gate, it changed the result. Everything else was the same.

Q. Let's go back again to CX103C204.

So you're saying when you're changing that yellow part, the thickness of the yellow part, it's acting as an insulator -- how do you know from here? Can you explain to me in simpler terms, please?

A. Yeah. So, first of all, the transconductance is the slope of these lines. That's -- it calls it transconductance up at the top, and the transconductance or the slope of these lines is changing with the thickness.

Now, if the p-GaN had been conducting, it maybe would look like say a copper wire, it doesn't matter how thick or thin that copper wire is. You're going to get the same result if it's conducting. So it should be a result more to the left than all of these and then as you add insulating layer, that transconductance goes down. The slope gets shallower.

Q. Okay. So just to be clear, you were mentioning the VG and the ID.

What is VG?

A. Gate voltage.

Q. Gate voltage.

What's ID?

A. Drain source current.

Q. Let's go back to that CDX7.1.

Can you tell us what current are you measuring?

A. You're measuring the current from the drain electrode down through the two-dimension electrode chrome gas and up the source electrode to ground.

Q. Up to the source electrode you said?

A. That's the current we're measuring, yes.

Q. Okay. You're varying the voltage where?

A. Varying the voltage on the gate metal.

Q. Okay. And you're saying as you were increasing and decreasing in the voltage, you're seeing changes in the current?

A. Yes.

Q. Okay. Let's go back to CX103C204.

And that tells you that it's in an insulator?

A. No. What tells you it's an insulator is by varying the thickness of the p-GaN region the thicker you make it, the lower the transconductance, it means that that had to be -- well, it says here fully depleted or nonconducting at all.

Q. So fully depleted means nonconducting?

A. Correct.

Q. Depleted of what?

A. Well, depleted of any carriers. You know, all the magnesium was not conducting.

Q. Okay. So we look at these curves you have like three colors, a group in blue and in yellow, and my wife tells me I'm colorblind, just one second, green, and the steepest one is blue. What does that suggest to you? What does that belong to?

A. That's the thinnest p-GaN region.

Q. So that's more conductive?

A. Well, it's a thinner capacitor. The plates are closer together. So it should have higher game.

Q. Why don't you just call it a capacitor?

A. We use the language of the era, whatever that was.

Q. Let's do that. What's a capacitor?

A. Well, a capacitor, I mean, it's a well-known component in electrical engineering. It's two metal plates with an insulator in between.

Q. Got it.

Now, had the p-GaN in those devices that you might have -- your devices in lot six and eight and five, had it been a conductor, what would the curve look like or curves?

A. Well, it probably would have been a little

sharper than the blue lines, a little bit more vertical than the blue lines.

Q. And what about for the different thicknesses which --

A. It wouldn't have made any difference.

Q. So they would all collapse into --

A. They would all have to be the same.

MR. ZEINEDDIN: Your Honor, may I approach the witness with a copy of the same page?

CHIEF JUDGE CHENEY: You may.

BY MR. ZEINEDDIN:

Q. And I'm going to hand you, Dr. Lidow, a red pen, and if you don't mind, if you can draw with that red pen where what would look -- what would it look like if this p-GaN had been conductive and if you don't mind putting your initials next to it.

A. Sure.

MR. LAVENUE: Objection, Your Honor. This is the type of thing that's done by an expert. This is not the type of thing that's done by a lay witness. His knowledge is one thing.

The information that he has in his head, he can answer questions, but making exhibits for trial, that's not -- that's something beyond what I've normally seen a layperson do.

Also, the question is based upon what would hypothetically be done based upon the data with a summary of the data that would come from an expert, not from a lay witness.

CHIEF JUDGE CHENEY: So if this were an assault case and someone said please point on the dummy to where they hit you, you're saying that a lay witness could not answer that?

MR. LAVENUE: I think that's a different example, Your Honor.

CHIEF JUDGE CHENEY: Isn't that exactly what's going on here? This witness is saying this is my testimony for what I observe and I'm drawing it on the page?

MR. LAVENUE: He can testify as to what he observes, but to conclude based upon what he observes from his analysis, that -- the conclusions are reached by an expert, not by the lay witness.

CHIEF JUDGE CHENEY: Do you have -- return to the lector and give me a response, please, Mr. Zeineddin.

MR. ZEINEDDIN: Thank you, Your Honor.

What we have here, Your Honor, is an inventor and that inventor is testifying specifically to the facts that occurred and specifically to the words that he wrote back in September 28, 2008, along with his colleagues and sitting down and discussing it and analyze it, the analysis

as we have heard from the testimony thus far is predicated on a relative slope with a reference point to what is conductive and what is insulating as it existed in their mind at that point in time as they were trying to predict and understand what was going on.

Now, here comes the point: Dr. Lidow is a fact witness. Every question I have asked him so far centered upon facts that he is recalling and that he's testifying to through a contemporaneous document, his inventor notebooks that they have cited in their pretrial brief to which that are listed in exhibits and that he's positing the witness for.

I cannot convert him into someone who never went to college and rendered his words and understanding all of a sudden that of somebody who is in high school who has never taken any courses back and put him -- place him back in 2008 in September 22 and ask him what these words mean.

I'm only asking him what these words mean and what the reference point is and all of that I believe is going to help the Court. I believe we don't have a jury here, so there is no confusion, and I believe Your Honor and the Commission will be able to weigh the evidence and we are not relying on Dr. Lidow for infringement at all. We're not even relying on him to provide domestic industry.

He is here to tell the Court what he and his colleagues have done, all Ph.D.s, right, and what we're talking about is sophisticated process of experimenting and doing research as opposed to just implementing, and he's explaining that part and part and parcel of that process is to understand the reference point of what you expected when he already testified he expected a conducting GaN. That's what the Nobel Prize winner told him it's going to go, and all I'm asking him to do right now is draw a line, show me what he had expected.

MR. LAVENUE: To use your example, Your Honor, you --

CHIEF JUDGE CHENEY: Can you please turn on your microphone, sir?

MR. LAVENUE: To use your example, Your Honor, you asked what if the witness were testifying where did he hit you, point me to it on your body. That's not the question that's at issue.

The question at issue is where else could I have hit you on your body and what would happen if I hit you somewhere else? The question is a hypothetical.

The question that was posed is: I'm going to hand you a red pen. Where would you look if this p-GaN -- if this p-GaN had been conducted, and if you don't mind putting your initials next to that, the question is where

would you put your data if it were different from what's shown here? That is a hypothetical for an expert. Only an expert can provide testimony about something that was not within the document.

Counsel for EPC says I'm asking about his response on what the point -- on what he's pointed to in this document. That's not it. He's asking for a hypothetical and to draw a line that is not in the document and not based upon the data, but something that is a hypothetical that only an expert would testify to.

CHIEF JUDGE CHENEY: The Staff wishes to be heard?

MR. WINSTON: Yes, Your Honor.

The Staff -- in the Staff's view, what the witness is being asked to do is to explain the statement on this document that he prepared back in 2008.

He says that this suggests that the p-GaN is fully depleted and the questioning has to do with why does that -- you know, what's the basis for that statement? And so I think this is entirely appropriate for a lay witness to give testimony on.

CHIEF JUDGE CHENEY: The objection is overruled.

Please proceed with marking the exhibit, Doctor.

MR. ZEINEDDIN: Thank you, Your Honor.

THE WITNESS: Thank you, Your Honor.

CHIEF JUDGE CHENEY: Mr. Zeineddin, will you publish the exhibit on the document projector?

MR. ZEINEDDIN: I will do so, Your Honor. I hope I know how to do this.

CHIEF JUDGE CHENEY: Just a moment.

BY MR. ZEINEDDIN:

Q. So, Dr. Lidow, you did not put your initials next to what you drew.

May I hand you back the document?

A. Yes, please.

MR. ZEINEDDIN: With your permission, Your Honor.

CHIEF JUDGE CHENEY: You may.

THE WITNESS: Sorry about that.

BY MR. ZEINEDDIN:

Q. Thank you, Dr. Lidow.

CHIEF JUDGE CHENEY: Mr. Zeineddin, will you mark the exhibit, please.

MR. ZEINEDDIN: I will, Your Honor. We'll mark this as exhibit CX980, which I believe is our --

CHIEF JUDGE CHENEY: Can we call it a CDX, please, of some sort?

MR. ZEINEDDIN: Yes, CDX, and somebody will

hand me a note telling me what our next CDX is in a second, Your Honor.

BY MR. ZEINEDDIN:

Q. Dr. Lidow, what you drew right here, that's what you wanted -- that's what you thought you were going to get; is that correct?

A. That would be -- that was consistent with what we expected in a conducting p-GaN layer.

CHIEF JUDGE CHENEY: Okay. Let's pause.

Counsel, let's get a good label for the record, please.

MR. ZEINEDDIN: I just need a number for the CDX.

Two. That will be CDX2, Your Honor.

CHIEF JUDGE CHENEY: Okay. Can you rotate it 90 degrees?

MR. ZEINEDDIN: There we go?

CHIEF JUDGE CHENEY: Thank you.

Please proceed, counsel.

BY MR. ZEINEDDIN:

Q. So, Dr. Lidow, how did you feel about that finding?

A. I think, as I mentioned earlier, this was the, you know, the big a-ha moment because, you know, these devices didn't have leakage current and we didn't

understand why and now we understood that the p-GaN despite our efforts to activate it was not conducting, but it still was a good enhancement mode device.

Q. Why do you say it was still a good enhancement mode device?

A. Well, that's what this shows is that with positive voltage on the gate, you turn it on and it conducts a lot of current, and that's a good transistor, and that's what we were looking for is a transistor that turned on, conducting a lot of current, doesn't leak in the gate and blocks -- and blocks a lot of voltage.

Q. Thank you, Dr. Lidow.

MR. ZEINEDDIN: So, Your Honor, I'm being advised with your indulgence to mark the exhibit as CX183 with your permission.

CHIEF JUDGE CHENEY: That's fine.

MR. ZEINEDDIN: Thank you, Your Honor.

CHIEF JUDGE CHENEY: I want the record -- tell me a number.

MR. ZEINEDDIN: CPX-183.

CHIEF JUDGE CHENEY: Okay. And this is a demonstration of or an illustration rather of the testimony provided by the witness in court today of his memory, is that right?

MR. ZEINEDDIN: That is correct, Your Honor.

CHIEF JUDGE CHENEY: Okay.

MR. ZEINEDDIN: And I tried to convert the CDX to that. I believe it's legible.

CHIEF JUDGE CHENEY: I'm sorry for this confusion. Ultimately this is not going to be a physical exhibit. I don't want it to be a floating piece of paper in the secretary's office that is with other physical exhibits. I want it converted to a PDF and filed as a demonstrative exhibit that illustrates the testimony. I'm sorry for this confusion about the label. So can we get it back to CDX2?

MR. ZEINEDDIN: Yeah. If I may put a CDX1000 just to make sure because that we probably have a third demonstrative there.

CHIEF JUDGE CHENEY: That's fine, but I want it converted to a PDF.

MR. ZEINEDDIN: Okay.

(Complainant Exhibit Number CDX-1000 is received.)

MR. ZEINEDDIN: So here we have CDX1000, and for the record, that is originally a printout from CX103C-204. It was a printout where the witness, Dr. Lidow, had marked a line in red and initialed next to it and now this exhibit is marked as CDX-1000?

CHIEF JUDGE CHENEY: Thank you.

MR. ZEINEDDIN: Thank you, Your Honor. Thank you for your indulgence.

BY MR. ZEINEDDIN:

Q. So actually we can take this off and I can just go back to -- oh, yes. So going back to CX103C, Dr. Lidow, what did you do, if anything, of this result?

A. Well, I mean, once -- what we did was we did a lot nine and we also -- you know, we tried to vary in particular the activation of the p-GaN and I think that that was also entered into my notebook.

Q. Okay. So do you think -- by now how many -- how much time has passed since you started EPC?

A. Well, I think the analysis of lot nine was also in September. So we're now, you know, 10 months in.

Q. Okay.

A. Almost 11 months in.

Q. And do you have that analysis written down for lot nine?

A. Yes. I think it's in the inventor notebook.

Q. Okay.

Can we go, please, to CX103C now at 206, and I believe that's stamp three in your binder if you wish to look at it or you can just look at the screen if you'd like.

What is this, Dr. Lidow, what's shown on the

screen before you.

A. So, again, it's a table showing the conditions that we -- that we used for the various wafers in this lot nine. So the wafers number is on the far left. The EPI material is in the second one from the left, which by now we know it's insensitive to those conditions and now we're trying to see if it's sensitive to the conditions in the third column, which is labeled p-GaN activation and, you know, from all the prior lots we had done 875 degrees for 60 seconds and we wanted to see at this point did it make any difference.

Q. Did what make any difference?

A. Trying to activate the p-GaN at this stage.

Q. So you're talking about column two that says p-GaN activation?

A. Yes. That's actually the third column from the left, yeah.

Q. Forgive me. Column three.

And so I see one, two, three, four rows corresponding to wafers where it says 87560 and I see below that one, two, three, four, five rows of wafers corresponding to a place that says none.

Could you explain that?

A. So the wafers -- the first, what, four wafers went to the RTA machine for 875 degrees 60 second

activation and the other wafers where it's marked none, they skipped that step.

Q. What is an RTA machine?

A. Rapid thermal anneal.

Q. Got it.

And that's the place where you're trying to get rid of the p-GaN you're cooking the hydrogen out?

A. Yes.

Q. Okay. So what did you conclude, if anything?

A. Well, I think that if we go to maybe the next page and even the page after that probably --

Q. If I may, I actually made a mistake. This was marked confidential, but I'm assuming it's okay for people to see it?

A. This is okay.

Q. How about the next one?

A. The next two pages are okay because the next page is not very interesting.

Q. What does it say? 161?

A. It labels the experiment RTA versus no RTA.

Q. Okay. And the page after that, which is --

A. And this is the result.

Q. This is for the record CX103C. 262.

Please go ahead, Dr. Lidow.

A. So, again, we're looking at a transfer curve

and the one on the left is just like the ones we've been looking at before. The one on the right is also a transfer curve just using a log scale on the vertical access. So I would at the moment just ignore that.

And the blue dots in curve here do not have that annealing step and the red dots or triangles and curves do have it.

Q. What does this mean?

A. Well, it means what it says. I think down at the bottom it says there is no significant difference in conduction characteristics between wafers with RTA and wafers without RTA.

Q. In other words, what does it mean?

A. Well, so now it's kind of completing a body of knowledge. We tried varying the conditions of EPI growth to try to vary the activation of the magnesium and we saw that it made no difference. Then we tried to vary the activation after the EPI growth and it seems to make no difference. So the only thing that seemed to make a difference was varying the thickness of the gate layer of the gate p-GaN layer.

Q. So just to be clear, are you saying here in this slide that whether you heat up the p-GaN to get rid of the hydrogen or whether you don't heat it up to get rid of the hydrogen, you're getting the same thing?

A. Yes.

Q. Okay. What, if anything, did that tell you about that material?

A. Well, it told us that something is deactivating this hydrogen -- this magnesium, magnesium.

Q. And then I believe you've already testified that that yellow material that the p-GaN is insulating?

A. Yes.

Q. So when you say it's deactivating, it's no longer acting as an acceptor?

A. It's no longer conducting. It's not -- it's acting like an insulator.

Q. Would another word be what?

A. Inactivated, semi-insulating, insulator, inactive.

Q. Okay. You just said semi-insulating and insulator. I mean, one is an insulator. What's a semi-insulator?

A. So an insulator would be something like a piece of wood and a semiconductor can also insulate like a piece of wood, but because in the semiconductor world it has the capability of being a conductor, they call it a semi-insulator just like a semiconductor.

Q. I'm sorry because I've heard a lot about that material could be called semiconductor, not much about it

being called a semi-insulator. Could you explain?

A. Yeah.

Q. I'm not trying to opine. Could you explain your usage of those terms right now?

A. Well, a semi-insulator is something that does not conduct, but it's made of a material that under certain conditions might conduct.

Q. Understood. Thank you.

So Dr. Lidow --

MR. ZEINEDDIN: We can take down the exhibit, Mr. Ortega. Thank you.

Q. So what you have on your hands now and how you said you're 10 months?

A. Yes.

Q. Now, let me pause here and ask you: Back when you were at the IR, you came out of Stanford, you brought in your colleague, and you wanted to work on the MOSFET just to orient you. You testified to that already. And you started working on it and then you ended up with the MOSFET and got passed on in the product.

How long did it take you back then?

A. It was approximately eight, nine months.

Q. And how long did it take you now at EPC back in September of 2008, how long had it taken you to do this and your team?

A. This analysis was 10 months after the founding.

Q. Understood. Thank you.

So now let's go back. Now, you're at the end of 2008. What are you doing now?

A. So, you know, we think we actually have something that might be a commercially available -- a commercial device, so we're building more of these and, you know, I'm starting to think about how to sell these devices and who might be interested in buying them and how we would market them.

Q. How are you doing on the finance kind of support front?

A. Well, money was going out pretty quickly and so we were -- I was certainly worried about that. I was, you know, selling assets. I was bothering and basically between me and the family money that I was borrowing, that was all the funding.

Q. Okay. And now you started selling?

A. Well, not yet.

Q. Okay.

A. I think that we had to not just perfect the device, but there were a bunch of other steps that we had to establish like making electrical connections that any user could connect to. We wanted to make a device that was the size and characteristics exactly that we felt fit the

market.

Q. But let's go back to those devices, you know, of lot nine.

You had set out to do two things at the beginning. Remind me again, the first one was what?

A. Wanted low leakage current.

Q. And the second one was what?

A. Enhancement mode device.

Q. And at that point did you achieve any of that?

A. Yes.

Q. On the low leakage current what did you do?

A. Well, the low leakage current was 100,000 times better than anything else that we'd read about or seen.

Q. And that's to be clear, we're talking about normally off gallium nitride transistors, double transistors; correct?

A. Yes.

Q. Okay.

A. With conducting p-GaN layers.

Q. Or actually normally off enhancement mode gallium nitride transistors whether they're power or not; right?

A. Correct.

Q. Okay. So the power just means that they can handle a lot of voltage; correct?

A. Yes.

Q. And then what about the other thing that you were trying to set out to do, which is I believe you testified was to make it small?

A. Yes. Small means low cost because if it's small, you get lots and lots of devices on the single wafer and that's what you want because the wafer is what you pay for. If you get 10,000 devices on a wafer, it costs half as much as if you have 5,000 devices on a wafer. Plus when you make it smaller, it tends to have lower capacitance, which means that it is a more efficient switching device. It will convert energy better.

Q. So now you're building these devices?

A. Yes.

Q. And you started selling them?

A. I think we sold our first samples in June of 2009.

Q. How did people react once you started showing the public what you have in terms of product?

A. We didn't show the public what we had until March of 2010. The reason we gave samples to one customer in 2009, was to get their feedback and that allowed us to I'll say really zero in on what the world wanted. It's called beta testing.

Q. Now, in power GaN devices you were saying the

IR was trying the depletion-mode, the normally on one. Were other people doing that as well?

A. At this time, there was nobody else out there with a GaN device other than Panasonic, and that was that enhancement-mode device with the high leakage gate.

Q. Did you think that people were working on devices like that?

A. Like Panasonic?

Q. Or like IR?

A. Well, we know that they were working on depletion-mode devices, there were several companies because they launched their device -- their -- other companies launched devices shortly after ours in March of 2010.

Q. Which companies were those?

A. Well, a company called Transphorm that's spelled with a PH, T-r-a-n-s-p-h-o-r-m. And then International Rectifier right at the time we introduced our products, they introduced their technology to the world. They didn't have any product, but they introduced their technology and it was a depletion-mode technology.

Q. So how did they react to your technology?

A. Well, publicly they particularly I think Dr. Mike Briere who was in charge at that point the GaN program, he disparaged our stuff as not being anywhere as

good as what he can do.

Q. Could you kindly spell his name for the record?

A. Yes. It's Dr. Michael Briere, B-r-i-e-r-e.

Q. And so those were people that are doing depletion, they don't do what you're doing.

Anybody else?

A. Well, the founder of Transphorm, Dr. Umesh Mishra who is a very well-known professor at UC Santa Barbara working gallium nitride, he founded Transphorm. And he also publicly and privately to me said that what we're doing will never be as good as what he's doing.

Q. And would you kindly spell his name for the record.

A. Yes. Umesh is U-M-E-S-H, and then his last name is Mishra, M-I-S-H-R-A.

Q. And -- well, did your device end up working better, your technology end up working better than the depletion-mode?

A. Well, initially we were the only ones actually selling devices. Other people were talking about what they were going to do. So, I mean, right away the very first day of launch we had, you know, hundreds and hundreds of pieces that were purchased.

Q. I understand.

Did other people react other ways or were there other reactions to what you came up with when you started selling the product?

A. Well, I mean, many people to our joy were really delighted because this did something that they had wanted to do for a long time. It allowed them to do something they wanted to do for a long time.

Q. Can you give us -- let's start with an example of something that actually happened.

A. Yeah. I mean, and it's one of the most wonderful things because the founder of a company called Velodyne, that would be V-e-l-o-d-y-n-e, immediately contacted us and he said that these -- and I say immediately, it was within a few months of announcing this, he contacted me. He said, you know, this is what I've been look for that I needed a device that had these kind of characteristics to make my sensor, which is called a LiDAR system, which is an acronym for light detection and ranging. He said: Now I can make a LiDAR system that has good enough resolution to, A, be better than radar, and B, perform the function of Google mapping, digital mapping of streets.

Q. So did he buy your product?

A. He bought our product. He built our product in. Google purchased his products and then Google took it

a step further and they started making autonomous vehicles, and then, you know, lots of people started using these LiDAR sensors for autonomous vehicles including autonomous robots and all sorts of things.

Q. So are you saying that your devices from EPC are in autonomous vehicles?

A. All of them.

Q. All of them?

A. All of them.

Q. Okay. What else? Can you give me another example of reaction?

A. Yeah. So another one was, you know, I get a call from the CEO of Microsemi Corporation. It's now part of Microchip and his name is James Peterman, and he said, look, I heard about your GaN devices, and I think that they would make really good devices for space applications and the big problem was in space there is a lot of radiation. It's also very expensive to put something up in space. So in order to make devices that are tolerant of radiation, silicon devices have to be sort of detuned or made very inefficient in order to be successful in space.

Also they have to add shielding in the satellites to keep the radiation from hitting these silicon devices because they're relatively delicate.

Gallium nitride had the potential of being

extremely robust in a high radiation environment and he wanted to partner with us to test that capability in advance of, you know, promoting it to be inside of satellites, and it takes several years to get into a satellite that actually gets launched.

Q. Dr. Lidow, so going back the LiDAR story, that started a couple of months after you introduced the product in 2010; correct?

A. Yes.

Q. Okay. Or was it 2009? I forget.

A. 2010.

Q. How about this one, how about the satellite ones?

A. It -- I think it was right at 2010, right around the launch time that he contacted me.

Q. And so what happened with your devices in that company?

A. Well, we started working with Microsemi first obviously validating, which they were successful at and they were paying us money as a stipend, which I looked at as infusion of blood at that time to keep working with them exclusively.

Q. And where are your products now with respect to this whole story?

A. Yeah. So I think, you know, our estimate is

that we've captured about 30 percent of that market now in space and there is, you know, we launched 150,000 parts last year into orbit around the earth and a couple of years ago and, by the way, I just learned this a week ago, a couple of weeks ago -- a couple of years ago we actually were on the Mars mission and we're in the Mars helicopter, the Ingenuity Helicopter that flew on another planet for the first time.

Q. Okay.

Dr. Lidow, so when you're putting stuff in satellite, you're selling to the government or the commercial or what?

A. Most of the stuff is commercial that orbits around the earth, that's all commercial, but, you know, Mars helicopter, that is NASA.

Q. Okay. Do you sell to any other parts of the government?

A. Yeah, we sell quite a few for various satellite programs.

Q. Understood.

Dr. Lidow, can you give me another example of people that were excited about your product back when you first showed it?

A. Yeah. So a company that makes headlamps for trucks, talk about a strange application I've never thought

about, contacted us because the problem that trucks, big trucks I'm talking, you know, what is it, 18 wheelers have is that they can't stop very quickly, and at night if you can't see very far, you sometimes can't stop in time to avoid an object.

So they wanted to make headlamps that would see much farther and to do that, they needed to go to headlamps that used LEDs, light-emitting diodes that are tinted slightly blue because that would allow your vision to see farther so you could see objects farther.

The problem with that was those LEDs had to be very carefully controlled so that their optical output doesn't change and they wanted all of this to fit inside the housing of a headlamp, and so our devices, of course, were perfect for that because they make very, very small systems and have a lot of power. So they could power these LED headlamps.

Q. And when was that? Around when?

A. It was in the 2011 time frame.

Q. Okay. Did anybody -- I appreciate all these companies.

Did anybody that we would know of that people would know of come to you and buy from you around that time or thought that your devices were good enough for them?

A. So, I mean, a bunch of semiconductor companies

bought from us. Well, one of our biggest early customers was International Rectifier, but we also sold to Texas Instruments; National Semiconductor; STMicroelectronics; Intel. That's a collection of some of the people that bought our products.

Q. Back in what year was that?

A. I think that was within the first a couple of weeks of launch.

Q. In 2010?

A. In 2010, yes.

Q. Okay.

Dr. Lidow, I want to ask you now let's move to today, talk about your products today.

How many transistors, different kind of product numbers of transistors do you make today, give or take?

A. Yeah, we have somewhere between 100 and 150 different part numbers.

Q. How familiar are you with each or any of them?

A. I am very familiar with each and every one of them.

Q. How can you be familiar with each and every one of them?

A. Well, I'm intimately involved in it. There are very, very few differences between them other than the size of the device and maybe the voltage that it blocks, but I

approve every single one of them. I know exactly which process goes into each one of them and I help sell and market them all the time.

Q. But what about the engineering part, not just sales and marketing, not just knowing them well enough to sell them, what about the engineering part?

A. Yes. Well, Joe Cao's office is adjacent to mine. We share a wall, so I can hear everything he does, but we obviously -- we talk all the time and I am in all the meetings that really are involved in moving the technology forward or creating a new device that requires a special approval by me, by the way, to make a new device.

Q. And so when you get -- when you approve that new device, what are you looking at?

A. Well, I mean, we certainly look at the economics of it. You know, I understand which technology or exactly what technology is going into that device. I certainly understand how it's built and why it's built at that point.

Q. And so when we're talking about device here, we're not talking about a computer or cell phone. What are we talking about? A transistor?

A. It's transistor. Sometimes an integrated circuit.

Q. Sometimes a transistor as opposed to standalone

with an integrated circuit, is that what you said?

A. Yeah, an integrated circuit would have several transistors on one chip.

Q. Understood.

So explain to me how different in terms of how they work and their characteristics and especially in that part of the gate that you're talking about, that yellow part between say what you had on your hands by lot nine at Episil and today across your products, if you can do so?

A. Absolutely. I mean, it's actually -- you know, to me it's fairly simple that all have a self-aligned gate and they all have a compensated gate electrode. They all have that same thing.

Q. When you say a compensated gate, what do you mean by that?

A. Well, the p-GaN gate material is nonconducting.

Q. How do you know that across all your products today?

A. Well, we measure leakage current and they don't leak.

Q. Yeah, but I mean forgive me, you can measure a lot of stuff that don't leak, but it doesn't mean they're all not leaking for the same reason.

A. Well, I mean, if they all have essentially the same threshold voltage, they have the same gate leakage

current characteristics and they have the same conduction characteristics, they are done in the same way.

CHIEF JUDGE CHENEY: And with that, we'll take our afternoon break. We'll take 15 minutes.

Counsel, I'll just note that we're about an hour and 15 minutes behind your schedule.

MR. ZEINEDDIN: Yes, Your Honor. I understand. Thank you.

CHIEF JUDGE CHENEY: Okay. We're off the record.

MR. ZEINEDDIN: Thank you.

(A recess was taken at 3:01 p.m., after which the proceedings resumes at 3:16 p.m.)

CHIEF JUDGE CHENEY: Please take your seats.

We're back on the record in the matter of 1366 investigation.

Before the afternoon break, we were listening to the direct examination of Complainant's witness, Dr. Lidow.

Counsel, please continue with your examination.

MR. ZEINEDDIN: Thank you, Your Honor.

BY MR. ZEINEDDIN:

Q. So, Dr. Lidow, I believe you stated that all of your products today are made the same way.

A. Essentially, yes.

Q. And are they still made fundamental in the same way as the products that you made even back in lot nine as far as how they reduce leakage current?

A. Yes.

Q. So, Dr. Lidow, let's look at your products now. Let's do this from memory, your memory. And that yellow part, that p-GaN, tell me, does it vary across your products and if it does, how?

A. So, you know, over time we've refined the manufacturing process and, you know, made some improvements so that p-GaN yellow layer has some very thin layers inside of it, that is essentially still magnesium-doped GaN.

So, for example, one variant might be to put a few angstroms of a gallium nitride spacer and in some of our devices -- and that would be at the bottom of the p-GaN gate and then some devices have two spacer and there are just a few angstroms each.

Q. What do these spacers do?

A. Well, so in order to explain what they do, the next layer is something called an etch stop layer, and we add a little bit of aluminum into the p-GaN because it slows down the etching process and then these two spacers allow the rest of the etch to proceed more uniformly across the wafer.

Q. I understand.

So these are functionally -- these bottom parts of that p-GaN, the yellow part, they're there to help you when you're actually stop it and smooth it down?

A. Yes.

Q. Do they affect at all the performance of the device or the stick of the device in terms of leakage current in terms of how it performs or why it performs according to how much you know about your devices so far?

A. Not in any material way.

Q. And how do you know that comparing them to even the devices that you had in 2010, or what you had seen in lot nine?

A. Well, they still have extremely low leakage current and, you know, the processing yields may have improved because of this slowing down of the etch process, but the fundamental device works the same way. So the fundamental leakage of the gate is the same.

Q. Okay. So you said some of your devices have one, some have two, these GaN spacers, and some have the etch stop spacer?

A. Yes, I believe all of them have the etch stop today.

Q. Today?

A. Either one or two spacers.

Q. Okay. And that's at the very bottom?

A. That would be at the interface -- it was the dark blue to the yellow interface, right there.

Q. And how thick was that etch stop layer?

A. It's 2.4 nanometers, which is 24 angstroms.

Q. Okay. Anywhere else? Does the gate vary the p-type gate that's compensated?

A. Yes. At the top of the yellow region on that display and right under the gate metal we have put a few angstroms layer that is what we call a P AlGaN cap.

Q. Okay. What is that?

A. Well, and on some devices there are two of those which really just means it's a P AlGaN cap that's a little thicker. In some there is one and its function is to reduce the amount of gallium that dissolves off the surface of the gallium into the titanium nitride.

Q. Okay. I understand.

How does that in any way change the working of the device or the characteristics or the way it operates in terms of the title S ranking?

A. Yeah, so the net effect it has a very small impact on reducing the leakage current. When I say small it's probably, you know, goes from, you know, 1 microamp down to .99 microamps, you know, that kind of a level of impact. It really was put there to reduce the decomposition of p-GaN layer.

Q. All of your devices today and back in lot nine and lot eight have gone from a hundred thousand fold to one?

A. From a hundred thousand milliamps per millimeter down to one -- I'm sorry. 100 milliamps per milliliter down to one microamp or a ratio of a hundred thousand to one, and this might have taken it down to, you know, .99.

Q. Understood.

Let's talk about EPC today. How many folks work in R and D at EPC in the U.S.?

A. 43.

Q. And what do they do?

A. That's really the central R and D. That's where we do the device development, the process development. We invent new ways to, you know, improve devices. That's all done there in our R and D in the U.S. mostly in El Segundo, California.

Q. And what kind of background do these folks have?

A. I think we looked at it and what, 23 or 22 of them had Ph.D.s, and I think 19 additional had advanced degrees. The total was 41 had advanced degrees.

Q. Thank you, Dr. Lidow.

So those folks over here in the -- well, strike

that, please.

A new question: The type of R and D that you do in the states, how much of it is the inside of your transistors and how much of it is the other type of engineering work on the outside to integrate them into customer products or with some circuits they use them?

A. Yeah, I mean, the majority of it is to work on the guts of the technology.

Q. And that majority of that R and D that you do in the U.S. I believe, am I correct that works on the guts?

A. All of the stuff that works on the guts is in the U.S.

Q. Not outside the U.S.?

A. No.

Q. Okay. Because you do have R and D outside the U.S.?

A. We have about a dozen people outside the U.S. that are in R and D.

Q. Can you briefly and quickly kind of go through them if you don't mind?

A. Yes, sir. We have about I think six people in Europe. Both are in Italy or all in Italy and one of the groups is working on applications of our devices. They take our devices and make it work in customers kind of applications and the other group is an IC design group and

they take the technology that we develop and then they design integrated circuits with that.

Q. And who leads, if anyone, these people?

A. Bob Beach.

Q. Both the one -- everyone in Italy?

A. No. I direct the one in Italy that does the applications. Bob Beach directs the one that does the design.

Q. Okay. Any other parts of the world outside the U.S. where you have R and D people?

A. Yeah, so in Asia we also have about six people.

Q. Okay. And what do they do?

A. Well, so four of them work under the instruction of Dr. Cao to basically interface with our foundry. We now have two foundries, and they interface with those two foundries, and then two of them are in the Philippines and they also work for Bob Beach's group designing integrated circuits.

Q. Okay. So they're not designing the inside of your transistors?

A. That's correct.

Q. Okay. So let's go back to the folks that work in the U.S. in the R and D that you do in the U.S. inside of your transistors. What technologies are they working on? Are they in any way, shape, or form related to the

technologies of the aligned gate, self-aligned gate, which is one of the asserted patents here, the '508, or the compensated gate which is the '294 patent that's asserted here?

A. All of our core technologies are related to that.

Q. How so? I mean, you already invented that. We're done.

A. You're never done. There are also, you know, various ways of making it, you know, lower cost, higher performance, and, I mean, those are the two things.

Q. Okay. Thank you, Dr. Lidow.

And let's just by example talk about last year and the year before. I wanted to ask you -- I want to ask you how much percentage-wise of your revenue have you spent on R and D, and here I'm asking you, please, not only to tell me that and to tell the Court that, but also describe what you mean by R and D in terms of your R and D expenditure?

A. Yeah, so, I mean, I looked at financial accounting, you know, we use general accounting practices or GAAP, and, you know, we audit -- we have audits from Deloitte. So they validate this, but over the last two years, our R and D spending as a corporation has been 80 percent of our revenues. So actually a little bit higher

than that.

Q. Thank you, Dr. Lidow.

So do you think anybody else is using your patented technology?

A. Yes.

Q. Specifically the technology that you patented in the '294, the compensated gate, and also the technology that you patented in the '508 patent, you and your co-founders and co-inventors?

A. Yes.

Q. Okay. Do you want to name one?

A. Innoscience.

Q. How do you know that Innoscience is using their technology or how did you know?

A. Well, I think that, first of all, even before they launched products, they published a paper that showed a cross-section that looked very much -- it was very clear from that, and I think maybe you can show that paper.

Q. Could you tell me a little bit more about the paper before I show it?

A. Yeah, it's a 2017 IEEE paper, and that would be a peer-reviewed paper. It means it goes through a review process by other people in the scientific field. I believe Denis Marcon is one of the coauthors.

Q. Thank you, Dr. Lidow.

MR. ZEINEDDIN: Your Honor, I'm going to publish CX0226 that is an IEEE. Dr. Lidow is listed as the sponsoring witness for that paper on the exhibit list.

CHIEF JUDGE CHENEY: Okay. Before you do so, let's hear from the other side for an objection.

MR. LAVENUE: Yes, Your Honor.

We would object. This paper was not in the prehearing brief for EPC. It was not identified as anything that Dr. Lidow has ever commented on before. The comments that you would hear from him today would be the first comments that the Respondents have ever heard on this issue.

CHIEF JUDGE CHENEY: And your response, Mr. Zeineddin?

MR. ZEINEDDIN: So, Your Honor, interestingly, the exhibit before that, if Respondents would look at, is a warning letter that went from EPC's lawyers.

CHIEF JUDGE CHENEY: Can you tell me an exhibit number?

MR. ZEINEDDIN: Yes. I believe it's 0225. And that's a warning letter that was sent from EPC's lawyers to EPC saying, You're infringing our patent, attaching to it --

CHIEF JUDGE CHENEY: I'm sorry, just to clarify, the letter didn't go from EPC's lawyers to EPC.

MR. ZEINEDDIN: I'm sorry, to Innoscience. Forgive me, Your Honor.

CHIEF JUDGE CHENEY: Okay.

MR. ZEINEDDIN: Telling Innoscience, Take a look at the IEEE paper, which is now what I would like to publish CX0226. Look at that paper, look what you've said in there. You're using our patents. Stop it. So Dr. Lidow, I don't know who else, unless if you want me to bring that lawyer who is really not a party here.

CHIEF JUDGE CHENEY: Did you put it on the exhibit list and say that Dr. Lidow would talk about it?

MR. ZEINEDDIN: Yes, Your Honor. It's on the exhibit list. We've exchanged exhibit lists. Dr. Lidow is the sponsoring witness for that exhibit, and, by the way, they had the opportunity to depose Dr. Lidow and that's a letter that was sent to Innoscience that was produced along with the attachment, and all they had to do was just ask Dr. Lidow about it. That's not our fault if they chose not to do that.

CHIEF JUDGE CHENEY: Okay. Mr. Lavenue, anything else you want to add before I rule?

MR. LAVENUE: Yes, this infringement analysis, as counsel for Complainant noted, if it was something that was going to be submitted, it would have been submitted by the Complainant in the prehearing brief. It was not.

If they were going to submit something from the lawyer that they had to opine on this, then they could do that or their expert, but asking Dr. Lidow to comment on this when he has not commented on it in any paper form before, he has not put this in a prehearing statement, Complainant did not put this issue in the prehearing statement, this would be the first time that we've ever heard this from Dr. Lidow and, therefore, we would not have had an opportunity to address it either in response to the prehearing brief or at any other time in the case.

CHIEF JUDGE CHENEY: Mr. Winston, your views?

MR. ZEINEDDIN: Your Honor --

CHIEF JUDGE CHENEY: I'm sorry, I asked Mr. Winston for his views.

MR. ZEINEDDIN: Oh. Forgive me.

MR. WINSTON: Your Honor, I'm not sure exactly when this was -- if this was in the original exhibit list or not.

If it was, I mean, with a fact witness, there is an obligation to, you know, tell exactly what their testimony will be. There is not an argument being made that intentions were not given and that there would have been no reason to address this. This could have been addressed during fact discovery, and I'm not sure exactly how Complainants intend to use this, but I think this goes

more to weight than admissibility and -- but I'm not -- I'm not really sure where Complainant is going with this.

CHIEF JUDGE CHENEY: Okay. So, Mr. Winston, you don't have any reason to dispute Complainant's representations that this exhibit was on the exhibit list and indicated that this witness would be the sponsoring witness?

MR. WINSTON: That's correct, Your Honor.

MR. ZEINEDDIN: Your Honor, may I add something?

CHIEF JUDGE CHENEY: Only if you don't want me to rule in your favor right now.

MR. ZEINEDDIN: I'm just saying it's an unopposed exhibit list.

CHIEF JUDGE CHENEY: Another reason. The objection is overruled.

Please continue.

MR. ZEINEDDIN: Thank you, Your Honor.

BY MR. ZEINEDDIN:

Q. Could we please bring up CX0226.

Now, Dr. Lidow, I just to reorient you again in case if you've forgot where we were. You were saying -- I was asking you how did you know that Innoscience was using your technology, and you asked me to show a paper by IEEE, I believe an IEEE paper from 2017, and you said Dr. Marcon

was one of the authors. Is this the paper?

A. Yes.

Q. Okay. What do you want to tell us about this paper? How did this paper tell you, if anything, that Innoscience was using your technology?

A. Well, first of all, it's talking enhancement-mode GaN on silicon HEMT, which stands for high electron mobility transistor. And then if you scroll down to the bottom right of page one, there is two images, the top and the bottom. The top one is a -- an illustration of what the bottom one says. The bottom one has labels that were on the paper, and you can see TiN and p-GaN and AlGaN underneath that in very small letters, and you'll notice that the TiN and the p-GaN are, you know, completely perfectly aligned to each other.

Q. Thank you, Dr. Lidow.

So from that, what conclusion did you draw, if any, back in 2017 when you looked at this?

MR. LAVENUE: Your Honor, objection again. Objection again. So now I'm not objecting to the exhibit. Now, I'm objecting to the testimony. So the question is: What conclusions did you reach based upon your analysis of this paper? The question is asking a lay witness to interpret a document that is excerpt-type testimony. That is not appropriate from a lay witness. Only an expert can

interpret a paper such as this.

CHIEF JUDGE CHENEY: It's overruled. The question asked about his conclusions drawn in 2017, which is his own personal knowledge contemporaneous to the events.

Please proceed, counsel.

BY MR. ZEINEDDIN:

Q. Please go ahead and answer, if you don't mind, Dr. Lidow.

A. Pardon me? What was the question?

Q. Go ahead and answer, if you don't mind.

A. Yeah, I mean, they're perfectly self-aligned and that led us to believe that they're using the '508 patent.

Q. Okay. Is there anything else that had led you to believe that they're using say the '294 patent?

A. Yes. You know, their electrical characteristics of their devices were being touted as being identical to EPC's or even better than, and, you know, for that, I think Denis Marcon at a conference one year ago gave a presentation boasting about that.

Q. How do you know that?

A. Well, it was a public presentation and I think we have it here.

Q. I know, but were you at that conference?

A. Yes, I was.
Q. Did you see the presentation?
A. Yes, I did.
Q. Did you get a copy of it?
A. Denis Marcon gave me a copy of it.
Q. Denis Marcon of Innoscience gave you a copy of it?
A. Yes.
Q. And did you give this to the lawyers?
A. Yes.
Q. Okay.

MR. ZEINEDDIN: Your Honor, I'd like to publish CX003 and -- which is the presentation. It is yet another exhibit that's on the exhibit list, and Dr. Lidow is the sponsoring witness on the exhibit list per your ground rules.

MR. LAVENUE: Objection. Continuing objection for the same reason as before, Your Honor.

CHIEF JUDGE CHENEY: That it was not in the prehearing brief?

MR. LAVENUE: This one was in the prehearing brief, but it was not -- there was no testimony from Dr. Lidow or any indication of what Dr. Lidow would be saying about this. We had no notice at all.

CHIEF JUDGE CHENEY: But you did receive the

exhibit list saying Dr. Lidow would be the sponsoring witness for this exhibit?

MR. LAVENUE: Is that true?

We objected to it last night and we objected to it via email, and we were told to object when Dr. Lidow was on the stand.

CHIEF JUDGE CHENEY: Okay. I just want to understand. You did receive the timely exhibit list listing Dr. Lidow as the sponsoring witness for this exhibit?

MR. LAVENUE: Yes, Your Honor, and we objected.

CHIEF JUDGE CHENEY: Okay. The objection is overruled.

Is this one, by the way, also on the agreed exhibit list? Counsel, can you state affirmatively for the record, please?

MR. ZEINEDDIN: Yes, Your Honor, it is.

CHIEF JUDGE CHENEY: Okay. So, Mr. Lavenue, why do we have now two objections to exhibits that you did not object to being already admitted into the record?

Are you objecting to the exhibits or to the testimony or to both?

MR. LAVENUE: We're objecting to the exhibits to the extent that we objected to them at the times that they were entered.

CHIEF JUDGE CHENEY: So that's -- I don't understand that objection if you've already not objected and they've already been admitted into the record?

MR. LAVENUE: For purposes of any testimony that would be provided by a lay witness.

CHIEF JUDGE CHENEY: So you're objecting to the testimony, not for the admission of the exhibit?

MR. LAVENUE: In this case, that is correct, Your Honor.

CHIEF JUDGE CHENEY: Okay.

Let's be a little more precise in the future. Your objection is still overruled, but another objection to an exhibit that you've already agreed should be admitted will not be taken well by the Court.

Do you understand?

MR. LAVENUE: Thank you, Your Honor.

CHIEF JUDGE CHENEY: Okay.

MR. ZEINEDDIN: May I proceed, Your Honor?

CHIEF JUDGE CHENEY: You may.

BY MR. ZEINEDDIN:

Q. Dr. Lidow, is this the presentation that you received from Dr. Marcon?

A. Yes, this is the title page of the presentation, yes.

Q. Dr. Lidow, if you don't mind, if you can just

tell us what you want to show us here, that you had testified this presentation told you that they're using your '294 patent? Can you please show us?

A. Yeah. I think several pages down there is a comparison of their devices to our devices in a table.

Q. Just let me know where we should stop.

A. Keep going. Why don't you stop on that page.

MR. ZEINEDDIN: For the record, this is CX0003-0007.

A. So this is the first comparison that they make versus EPC's devices, and you'll notice that they're bragging in this case or boasting about the gate leakage current and how they've improved it. We know that is the graph -- the table chart that's in the middle says: IGSS5 volts, slash, WG, and that stands for the gate current that's conducting with 5 volts on the gate for every, you know, millimeter of gate width, and they flag, you know, .1, and there is I guess two distributions.

The one on the left, the average or centroid of it, is around .1, and the one on the right, the average or centroid, is around .3, and they boast about reducing the gate leakage current by a proprietary GaN epitaxial process, you know, to less than three microamps.

So, you know, obviously, it's clear that this is not a very conducting device, because it's even better

than the device that they're comparing against, which is -- has the same characteristics as ours, it doesn't list it as ours, but has exactly the same characteristics, and I don't know anybody else who produces it at this point.

And you can see there is an illustration on the left that shows the gate metal, the p-GaN, the AlGaN, the GaN channel, and it has a deleted 2DEG. So number one, they're comparing against what's probably ours, but I think a couple of slides down there is a direct technical comparison, so let's keep going. Keep going. There. Stop there.

MR. ZEINEDDIN: So for the record, this is CX003-0015.

Q. What does this slide tell you? What do you want to tell us about this slide, Dr. Lidow.

A. So this slide is comparing an Innoscience device, which is the farther right column, against two EPC devices, which are the two columns to the left of that, and it's comparing it for various electrical attributes or performance attributes, which are on the far left column, and you'll notice there is quite a similarity in just the way the devices look, and at the bottom, there is a contention that some of EPC power devices are pin-to-pin compatible with Innoscience and with similar specifications and then brackets and vice versa.

So here they're really promoting the fact that you can unplug our device and plug their device in and it will work just the same.

Q. So --

CHIEF JUDGE CHENEY: Before you go, Doctor, I want to make sure I understand your testimony about slide CX3 -- slide 15. Everything on this slide, except for the labels in the lower right-hand corner, originated with Innoscience; is that right?

THE WITNESS: Correct.

CHIEF JUDGE CHENEY: Thank you. Please continue, counsel.

MR. ZEINEDDIN: Thank you, Your Honor.

BY MR. ZEINEDDIN:

Q. So do you think --

(Clarification requested by the court reporter.)

MR. ZEINEDDIN: I'll withdraw the question, Your Honor. I'm just not going to pursue that line of questioning having already led the witness, so I'm not going to do that. So let's move on to a different topic.

Q. Dr. Lidow, did you ever receive any awards for the work that you and your co-inventors have done at EPC?

A. Yes, we received many, many awards over the years. In the early days we received several right away,

and I think I prepared a sheet that has some of those listed.

Q. Would it help you to remember which ones?

A. Yes, it would.

Q. Okay.

MR. ZEINEDDIN: If you don't mind, can we pull up CDX007.4?

Q. Is this the sheet you were talking about?

A. Yes.

Q. When did you prepare that sheet?

A. You know, August 2012.

Q. Could you tell us a little bit about it? What does this say?

A. It's I think a collection of many of the awards that we received very early on and that would be all the awards on the left-hand side. There are two awards on the right, which were received by National Semiconductor for making a device that worked with our device.

Q. Understood.

And what about the ones on the left, because this is a demonstrative, do you mind just testifying about these awards and describing them to the extent that they help you remember what they are?

A. Yeah. So, you know, the first one in the upper left is the Product of the Year Award from electronic

products. The next one on the top row is the EDN Hot 100. So we were a Hot 100 company.

Then ironically, the next one, it says: Silicon 60. It was the hottest 60 silicon companies, and it's ironic because we were making GaN devices, and then the three in the middle are all Chinese awards, starting with the EDN Innovation Award in 2010, the EDN China Innovation Award in 2011, and then Top 10 Power 2012, which was -- I forget the organization that issued that award in 2012. And then on the bottom you see that the EE Times Green Technology ACE Award and then an Innovation Award where we were a finalist in 2010.

Q. Thank you, Dr. Lidow.

MR. ZEINEDDIN: Your Honor, I pass the witness.

CHIEF JUDGE CHENEY: Thank you. Is there cross-examination for this witness?

MR. LAVENUE: Yes, Your Honor.

CHIEF JUDGE CHENEY: Please proceed when you're ready.

MR. LAVENUE: Thank you.

Ready, Mr. Wilson?

Thank you, Your Honor.

CROSS-EXAMINATION

BY MR. LAVENUE:

Q. Dr. Lidow, I'd like to put up an excerpt of JX14 from slide two. This is also in your binder which you have in front of you. You're one of the named inventors for the '294 patent; correct?

A. Yes.

Q. And on slide three, I'm showing you a portion of RX0009C, which is also in your binder.

Do you see that? It's on the screen as well?

A. Yes.

CHIEF JUDGE CHENEY: I hate to interrupt you, counsel. Is there a folder on Box where I can see these?

Let's go off the record for a second.

(Whereupon, a discussion is held off the record.)

CHIEF JUDGE CHENEY: We're back on the record now after taking a moment to deal with some exhibits.

Please proceed, counsel.

MR. LAVENUE: Thank you, Your Honor.

MR. ZEINEDDIN: Forgive me, Your Honor, may I?

CHIEF JUDGE CHENEY: Yes.

MR. ZEINEDDIN: I don't want to interrupt his cross-examination, but this is a confidential document and I believe based on this weight, I think he's going to go -- this is confidential to our client, EPC.

MR. LAVENUE: Okay. We're now in the confidential record. If you're not authorized to see EPC confidential information, please leave the hearing room.

Counsel, please proceed.

(Whereupon, the hearing proceeded in confidential session.)

O P E N S E S S I O N

CHIEF JUDGE CHENEY: We're on the public record.

Please proceed.

MR. LAVENUE: Thank you, Your Honor.

BY MR. LAVENUE:

Q. So we can go to slide 28, and I'm going to be citing from your book here. So we're looking at page 193 of your textbook, and this page discusses section 9.5, single event effects, SEE testing; correct?

A. I'm glad to see people are reading my book.

Q. Indeed.

And the second paragraph of section 9.5, it's titled in yellow on the screen, it says in your book, and you tell us, that a Schottky gate and a p-GaN gate have no insulating gate layers; correct?

A. Correct.

Q. And you agree that a p-GaN HEMT device has no insulating gate layers; correct?

A. The context here was a MOS-gated device and that's in paragraphs above. In other words, the insulator I'm referring to is the oxide insulation that traps charge when exposed to radiation.

Q. So, you know, you testified earlier today about

certain tests that were performed for exhibit CX --

MR. LAVENUE: And, Ms. Specht, you're going to have to come here and interpret your writing, with your indulgence, Your Honor.

Okay. Thank you.

CX0103C. And we would like to put that up if we could.

CHIEF JUDGE CHENEY: We're back on the confidential record.

(Whereupon, Chief Judge Cheney asks the stenographer later in this transcript to keep this in open public session.)

Q. So you remember that you testified earlier today about certain tests that you performed when you were asked by counsel for EPC?

A. Yes.

Q. And you noted that in those tests, there was a metal contact that you tested. Let's go to page 204.

And on 204, you mentioned that there is a metal contact that was tested.

Do you recall that testimony?

A. I don't know what you're talking about, a metal contact that was tested.

Q. So when you were describing this, you said that there was a doping of the p-GaN and that the doping of the

p-GaN involved a testing of the metal contact and a testing of the doping of the p-GaN.

Do you recall that testimony?

A. That doesn't sound like it makes any sense. So I'm not sure what the exact testimony was. Maybe before and after you could re-read it and I could understand it.

Q. Okay. So describe what is this -- this is p-GaN thickness depicted; correct?

A. Well, this is an experiment that the main variable is p-GaN thickness and it's looking at the transfer characteristics of devices with different p-GaN thicknesses.

Q. What was the metal contact for this p-GaN test?

A. I don't know what that was referring to at all.

Q. You don't know what I'm asking or you don't know the answer to the question?

A. I don't know what you're asking.

Q. So was there a metal contact for this device that you were testing with the p-GaN thickness? Was there a contact, a metal contact layer above or below?

A. Well, there are three metal contacts. There is a source, a gate, and a drain.

Q. And what were they made of?

A. Well, first of all, you have to connect to all three to get these curves and at the point of contact

they're all basically aluminum.

Q. So was the gate contact here aluminum?

A. Well, I think you may be, if I may, confusing gate contact with the gate metal layer.

Q. And was it aluminum?

A. The gate metal layer is titanium nitrite.

Q. Okay. That is the answer we're looking for. Thank you very much.

And now we can go back to the originally scheduled program.

So in your --

CHIEF JUDGE CHENEY: Counsel, I just reflexively put us on the confidential record because you said we were going to look at an exhibit with a C number, but everything I've heard has already been in the public record so far.

Let me just ask the witness: That same document is the document you testified about publicly. Do you have any problem with it being public?

THE WITNESS: No.

CHIEF JUDGE CHENEY: Okay. So I'm going to ask the court reporter to designate the last section as being on the public record, and we'll continue now on the public record.

Q. And let's go to slide 29, please.

So before founding EPC, you were the CEO of International Rectifier; is that correct?

A. Yes.

Q. And at International Rectifier, you saw oversaw research and development activities; correct?

A. Yes.

Q. And you left International Rectifier to found EPC; right?

A. I founded EPC after leaving International Rectifier, yes.

Q. And when you founded EPC, EPC did not have a license to any International Rectifier technologies; is that correct?

A. Correct.

Q. So EPC did not obtain any sort of head start for International Rectifier. Did EPC start from scratch?

A. Yes.

Q. Did you take any International Rectifier technology with you when you went to EPC?

A. No.

Q. Did you take any confidential documents or recipes with you from International Rectifier to EPC when you left International Rectifier?

A. No.

Q. Did you take any type of any trade secret information when you left International Rectifier and went to EPC?

A. No.

Q. So let me go to slide 30, and slide 30 shows the cover of exhibit CX103C, which is in your binder, and this is the scan copy that you saw before when you were being asked questions by your counsel.

Do you remember this?

A. Yes.

CHIEF JUDGE CHENEY: Shall we continue on the public record?

MR. LAVENUE: I believe everything according to Complainant in here is public.

MR. ZEINEDDIN: So far that's correct, Your Honor.

CHIEF JUDGE CHENEY: Okay. Please continue.

BY MR. LAVENUE:

Q. Are you aware that the original scan of the EPC document was a black and white version, but a new color version was just produced a couple of days ago? Were you aware that?

A. I'm not aware either way.

Q. No problem.

So this notebook describes EPC's research and

development efforts for its first GaN transistors that you described when you told your story to counsel for Complainant; correct?

A. Correct.

Q. And the work in this notebook led to the '294 and '508 patents; is that correct?

A. Yes, I think actually this one starts at lot five and I would certainly say that lot four also led to it.

Q. And that would have been part of what led to the '294 and '508 patents?

A. Yes.

Q. Okay. And so on the left, you see a table of contents; correct?

A. Yes.

Q. And one of the items is device lot five; correct?

A. Yes.

Q. And there are other device lots listed as well; correct?

A. Yes.

Q. And device lots were for product developments of EPC's epitaxy with its partner Episil in Taiwan; correct?

A. Well, some of them, I think device lot seven is

called device lot, but it was just meant to test some process parameters without making full devices.

Q. And on slide 31, I've displayed page 33, and 33 is from the inventor notebook.

This is an email that you sent on August 14, 2008; correct?

A. Looks like it, yes.

Q. And you sent this to others, including the other inventors of the '294 and '508 patents; correct?

A. Yes.

Q. And the subject of the email is pertaining to device lot five; correct?

A. Yes.

Q. And then at the bottom on slide 32, I've highlighted what your email says, it says, quote: These results are fantastic. What a turnaround from the initial data, end quote.

Do you see that?

A. Yes.

Q. There is even an exclamation point?

A. Yes.

Q. And then in August of 2008, Episil and EPC were experimenting with different epitaxy recipes at that time; correct?

A. No.

Q. No?
A. I believe the experiments in August of 2008 were still being done at Extron on their test machine.
Q. Okay. Understood.
And then let's go to slide 33. So slide 33 shows page 164 of the exhibit, and do you see that e-mail?
A. Yes.
Q. And this is an email that you sent on September 12, 2008.
Do you see that?
A. Yes.
Q. And this email states, quote: I am so excited about getting working samples from lot five, exclamation point.
Do you see that?
A. Yes.
Q. And then in September 2008, EPC was still experimenting with different epitaxy recipes to develop its products; correct?
A. Correct.
Q. So let's go to slide 35, and 35 we have pages 416 and 417 of the exhibit, and you can see here that on slide 35, I'm showing an excerpt from the top of page 416.
Do you see that?
A. Yes.

Q. And 416 through 417, that's an epitaxy recipe; correct?

A. Yes.

Q. And this recipe describes growth conditions for making GaN HEMTs; correct?

A. Yes.

Q. Let's go to slide 36. And then on slide 36, there is a date at the bottom and the date is August 26, 2008; correct?

A. Yes.

Q. And then on slide 37 --

CHIEF JUDGE CHENEY: What's the objection?

MR. ZEINEDDIN: We're now I believe on confidential information going since he started looking at those recipes.

CHIEF JUDGE CHENEY: Okay. Anything in the transcript that needs to be protected or is it just showing things on the screen?

MR. ZEINEDDIN: Your Honor, I believe just what's shown on the screen.

CHIEF JUDGE CHENEY: Okay. We'll continue now on the confidential record. If you're not authorized to view EPC confidential information, please leave the hearing room.

Counsel, please continue.

(Whereupon, the hearing proceeded in confidential session.)

O P E N S E S S I O N

CHIEF JUDGE CHENEY: He's been excused from the stand with instructions not to discuss his testimony. We'll continue with examination by the Commission Staff and any redirect examination tomorrow.

Counsel, tomorrow I'd like to understand the status of the exhibits that were reviewed during cross-examination by Complainant -- or sorry, by Respondents for this witness. So when we're doing housekeeping, let's do this -- let's finish the testimony of Dr. Lidow before we do discussions of tomorrow's exhibits, and at that point I'm going to have some questions about the status of some exhibits that I saw during cross, okay?

MR. ZEINEDDIN: Understood. Thank you, Your Honor.

CHIEF JUDGE CHENEY: Anything else?

MR. LAVENUE: Thank you, Your Honor.

CHIEF JUDGE CHENEY: Okay. We are not too far behind at the end of the first day. That was some good makeup. So be mindful of your time so that we can get a full record and not run out of time by Friday. We're off the record. Have a good evening.

MR. ZEINEDDIN: Thank you, Your Honor.

MR. DOSHI: Thank you.

(Whereupon, the proceedings concluded at 4:37 p.m., to continue the following day, February 27, 2024, at 9:00 a.m.)

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C E R T I F I C A T E

TITLE: CERTAIN SEMICONDUCTOR DEVICES

INVESTIGATION NO.: 337-TA-1366

HEARING DATE: February 26, 2024

LOCATION: Washington, D.C.

NATURE OF HEARING: Evidentiary Hearing

I hereby certify that the foregoing/attached transcript is a true, correct and complete record of the above-referenced proceedings of the U.S. International Trade Commission.

Date: February 27, 2024

SIGNED: _____

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Washington, D.C. 20005

Signature of the Contractor or the Authorized Contractor's Representative

I hereby certify that I am not the court reporter and that I have proofread the above-referenced transcript of the proceedings of the U.S. International Trade Commission against the aforementioned court reporter's notes and recordings for accuracy in transcription in the spelling, hyphenation, punctuation and speaker identification and did not make any changes of a substantive nature. The foregoing/attached transcript is a true, correct and complete transcription of the proceedings.

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I hereby certify that I reported the above-referenced proceedings of the U.S. International Trade Commission and caused to be prepared from my record media and notes of the proceedings a true, correct and complete verbatim recording of the proceedings.

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