Specialty Materials

COMPOSITES CORNER

Guest:

Don Osment

Senior Consultant, Advanced Composite Materials

with

Monica Rommel, CEO, Specialty Materials, Inc.

Q: What is your position in the industry?

Rommel: I've been a materials engineer for two large aerospace companies. First was Northrup Grumman in the fighter aircraft industry and then the second was with L3Harris in the space payloads area, and my expertise has always been in supporting design engineering with new applications for composite materials for these high performance systems.

Osment: My position in the industry is doing research and development of advanced materials for U.S. government applications.

Q: What does your company do?

Rommel: Our company produces materials that are used both in space systems as well as defensive weapons like the F15 fighter jet, and the reason they use our materials is because of the high specific properties; they can make a much lighter weight, higher performance structure.

Osment: And we function as a sub-tier supplier to the prime contractors and tier-one fabricators of those articles, so we're a little bit further down the supply chain, but we're an important and crucial element in making those structures perform and out-perform their adversaries.

Q: What trends are you seeing in the composites industry?

Rommel: I think one of the biggest trends we're seeing is the re-introduction of what they call thermal-plastics into the industry. Thermal plastics have a lot of advantages in terms of recyclability and then also it opens up a new avenue of manufacturing that can be used to manufacture composite parts which is more similar to how metal parts are fabricated. And then I also think we're seeing an evolution in both the resin and the fiber systems where they're continuing to improve properties at the nanoscale level that is resulting in an even higher performance, more processable system, specifically geared towards very high-performance applications.

Osment: As far as the trends in the composites industry we're seeing a little bit of a Golden Age and a renaissance of bringing back a lot of the space-based type materials, the next generation of satellites, commercial and military launch vehicles, as well as a resurgence in space exploration, as well as demanding U.S. military needs. So, across the board I think we're feeling the pull of faster, farther, lighter, and at the same time, having a good eye on cost reduction initiatives.

Q: Where do you see the industry going in the next year? Five years?

Rommel: One of the big trends is around personnel. There needs to be an entirely new generation of composite materials engineers like Don and myself that basically benefit from the knowledge that we've gained throughout our career. So we need to encourage more people to go into STEM and science and to pursue opportunities like that for their careers.

Osment: Outstanding, Monica. And as far as trends we're seeing a lot more of a pull of green engineering, and so we're looking at ways to help our ultimate customers and OEMs have a lower carbon footprint and a lot of that has to do with our lighter-weight materials that we can supply here. As well as the overall pull in the industry for seeing something that also fits the needs of individualized transport, so there is likely going to be a lot more going on in the urban air mobility-type markets, and more personalized-type transports that also have that demanding need of green technologies as well as lightweight structures for increased distances.

Q: How are you seeing composites used? Which industries?

Rommel: You see a lot of it going into aerospace products, and compared to where Don and I started at the beginning of our careers it was perceived to be a tremendous amount of risk to create primary composite structures and I think that inversion to composites has completely gone away. So I think you see it throughout the aerospace industry. I know when I started my career people thought you'd never seen a composite fuselage on an aircraft and Boeing proved them wrong when they built the 787. And sporting goods has always kept up with state-of-the-art materials, you see a lot of sporting goods applications where they're really pushing the envelope of performance, and they're creating some products that are now being adopted by the aerospace industry like what they call "spread-toe fabrics." And then wind energy, I think composites has revolutionized that industry because of the stiffness and weight you can get from a composite fan blade, and I think you're just going to see it go into more and more industries, like Don mentioned the urban air mobility. It's really an enabler for that kind of application because you're really going to reduce fuel consumption.

Osment: Monica, you covered all the big hitters. Of course there's also the medical industry where composites are being used for artificial limbs which add a lot for improved mobility for folks. And we have other medical areas as well where there's some specific use of composites being adopted. Automotive, certainly, as the vehicles try to be more efficient

overall in energy, whether it be traditional fuel, hydrogen, gas, or electric, they're making use of composite materials. In fact, I drive an electric car that's got a composite frame. So there are a lot of really good opportunities for composites in almost every field across some broad and divergent areas.

Q: Where are composites having the greatest impact?

Rommel: I guess one of the stories that hasn't been told about composites is the impact it's had on commercial aviation. They're just starting to get some of the long-term data and they're finding that maintenance associated with use of composite materials is much less than they anticipated and also much less than what they have to do for traditional, like aluminum, aircraft. So I think the benefits of composites as that information gets out into the marketplace is really going to have a much greater impact on quick adoption by other industries once they see that it can lead to not having corrosion issues, not having fatigue issues. And also once the green composite initiative, it'll provide a very easy recycling stream.

Osment: Yeah, absolutely Monica. To capitalize on that, as far as the transportation industry I think that's where it's having the largest impact, and also the energy markets in particular. Monica mentioned the wind energy benefits of wind blades and other areas for composites, but also in the transportation areas for automotive or for flight, we see that as a huge opportunity for composites to really make a large difference and have a greener future tomorrow for our children and grandchildren.

Q: What benefits are customers experiencing from composites?

Rommel: I think there are customers who see composites as enabling for certain types of systems that give the United States a very strategic advantage over some of their adversaries. So there are things that they wanted to do but they couldn't do because of weight, because of center of gravity, because of performance under different types of loading conditions, and composites are finally getting to the maturity where they can address those issues and basically create like a whole new set of war fighting tools.

Osment: And the benefits that the customers can realize are slightly hampered by the lack of the next generation of designers coming up through the ranks that can make the best use of the composite materials. They're a little bit more difficult to design and analyze than a traditional metal or plastic material, so it takes a bit more training and database on the particular composite material. But reaping the benefits from it the customers can have structures with greater lifecycles, aspects like Monica mentioned, especially on the 787 is a great example, much better fatigue resistance and overall a better aircraft for everyone. So certainly a huge benefit for the customers that are making use of these advanced materials across the board.

Q: How has the industry changed since you first entered it?

Osment: So, the industry change is unbelievable, this is my 43rd year working in composites for the defense and military markets. When I started the predominant material being used in production was a fiberglass composite material. All the calculations were being done by hand. There were actual blueprints made for making these structures. And the calculations for creating the design and engineering was just going from a slide-rule to a calculator, and I often times was criticized by my engineering peers when I first started working that I didn't really know how to use a slide-rule and I'd better make sure my batteries never run out on my calculator. So that's how the industry started. So the computers revolutionized the industry, in particular the robotics, automated controls, the inspection technologies, as well as the design and engineering. These fiber composite materials can be quite complicated, they're multi-angled layup structures, and because of that, you need some high-powered computing devices to go through and properly analyze and give a lifecycle projection on what that design and structure can handle. So, the advent of the computer age has greatly revolutionized the composites application to the marketplace.

Rommel: I've been in the industry 38 years so I'm a little bit of an infant compared to Don, but when I first started they used to call it a "black art" because it was a lot of trial-and-error and people had all these war stories and there were tales about how you would get a part made a certain way, and I think the science has really been put into the industry and it used to be when you started to develop a component you would do coupon testing and then component, or sub-component then component then an element then an entire structure, and I think a lot of the foundational work has now been done so there are test methods so you don't have to test the material. When Don and I started there was a lot of art and craft to doing that and every company tested the same property different ways, but now that's all been standardized. Now there are test centers like the National Institution of Aviation Research that developed databases that can be used nationally. I think like Don said, originally you would have somebody design a part, then they had to do a CAD drawing of it, then somebody would take that CAD drawing and they'd make another drawing to build a tool, and then they would program a machine to cut out the shape for the tool, then you would get that tool in-house and you would have to get the material and lay it on the tool and develop the patterns and then a drawing would get made of those patterns and there might be two or three iterations, and then you'd finally cure the part and then you'd find out the part didn't have the right dimensions, and then you'd start that cycle back again. But now with the use of being able to take digital data imported through the whole process, it's really streamlined things, reduced cost, and then the expertise in terms of predicting what you want to build versus what you have the tool for has gotten a lot more sophisticated. There's a lot less trial-and-error in the industry, which is really good because it reduces cost and I think it opens up composites to a lot more industries.

Q: What words of advice do you have for those looking to enter the composites industry?

Rommel: I would say go for it. I have had fun in my career, I'm always learning, I've never regretted the trajectory that I've been on. I think you work with a lot of talented people, you work with a lot of bright people, you're always solving interesting problems, so I say get the education and dive right into this industry – it's phenomenal.

Osment: And I would add in there: don't be afraid of failure. I think a lot of folks get out there, especially we learned this in the early days, like Monica had talked about the trial-and-error and you build a tool and fabricate a part and then find out it sprung back and had the wrong dimensions and you have to start over again. It's easy to give up and easy to walk away, but the hard things and the worthwhile things take time, they take effort and it requires a lot of self-motivation to get there. So my big words of advice are to not get discouraged and to listen to your peers but know that you learn from your mistakes or from the failures along the way. And figure out how to make that part a little bit better next time and it definitely will come across that way.

Q: Are there ways that the composites industry is contributing to green initiatives and reducing carbon footprints, or ways that your organizations are doing that?

Rommel: One of the biggest things if you make a vehicle that weighs less it uses less fuel, and composites will hands-down do that almost every time.

Osment: Absolutely, Monica. And I was thinking the same thing. As far as the initiatives, the greener aircraft like the 787 example and the composites that are used in the fuselage area there, it certainly contributes greatly to the lower fuel consumptions for that aircraft. And as well as for automotive transportations where composites are used there to lighten the vehicles and allow either more load or certainly less fuel or less energy consumption. And in a big way in support of that, we would not have the wind blade and windmill technologies without the use of the modern fiber composites. That particular material and the stiffness and strength that's required to achieve that would not be possible with a metallic structure. In general we owe a lot to a greener, brighter future with this continued use and evolution of high-tech, high-strength composite materials.

Rommel: And I guess what most people don't know is that most metals that are used to build things, it starts with a mine and it goes through refinement and it goes through melting, a very, very energy-intensive with heavy tolls to the environment. And the other thing about metals is you get a big block of it and you may only use 20 percent in your application and the rest gets thrown away. It can be recycled but then it still goes through a

different process to get it back to a form that somebody can use. And composites in most cases are fairly close to being a net-product. You do have some waste from cutting, but you're basically building the shape you need. You're not, what they call "hogging it out"of a large piece of metal. So that's a much better value stream for the environment.