Expert Interview: Peak Nano | Brückner Servtec

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Fusion energy is gaining momentum as a clean and scalable power source. For those less familiar, could you briefly explain how fusion works— and what makes it so fundamentally different from traditional energy systems?

Dr. Michael Ponting: Fusion works by combining two hydrogen atoms into one helium atom under extreme conditions – temperature, density, and confinement – releasing a neutron and excessive energy that can be captured and stored. Unlike traditional energy sources that require a chemical change, such as burning oil, gas, or coal, fusion doesn't consume carbon or produce significant waste.

Compared to nuclear fission, fusion generates very little byproduct, and what it does produce is far less hazardous. The fuel that powers fusion – isotopes of hydrogen, most commonly deuterium and tritium – is extremely energy dense, and used in much smaller quantities than the uranium or plutonium used for fission, making fusion plants much more

space and fuel-efficient. In fact, fusion can yield up to four times more energy per unit of fuel than uranium-based fission, making it a much more efficient and sustainable energy source.

In conversation: Ben Sandelowski (Brueckner Group USA) with Dr. Michael Ponting (Peak Nano) at the Customer Days 2025

Your presentation at the Customer Days event highlighted the surge in private and public investment in fusion. How is this momentum shaping the demand for capacitor films, and what role do they play in enabling both magnetic and inertial confinement systems?

Dr. Michael Ponting: In the last five years, we have seen more than $12 billion in private investment in fusion, rapidly propelling the industry and the technology needed to support it forward (The Fusion Report). This momentum is pushing companies to move beyond core fusion technologies and focus on building up the supporting systems, like fusion-ready capacitor films, that are essential for bringing fusion energy to the grid. Fusion systems require advanced energy storage systems, which depend on capacitor films that are more

reliable and durable than the legacy films widely used today. As the frequency of fusion prototype builds increases (over 70 active programs globally), the entire supply chain, including consumables and auxiliary components, must scale accordingly.

Demand for films is set to more than double as fusion progresses, making this the first new market capable of significantly expanding the capacitor film business. Fusion has transformative potential for both the capacitor film industry and the future of energy.

Peak Nano is known for its innovations in capacitor films. What specific challenges do you face when developing materials for high-voltage, high-frequency environments like those in pulsed power fusion systems?

Dr. Michael Ponting: Fusion is driving a performance change in the requirements for capacitor films (higher energy storage, longer lifetime, and resilience at extreme temperatures). The industry needs huge volumes of high-performance material to become available on very short timelines – far shorter than the typical 10-year research and development cycle for new materials. Fusion companies are seeking capacitors that can handle billions of charge-discharge cycles beyond the hundreds of thousands of charge-discharge cycles that capacitors support today. According to market projections from Ignition Research, if fusion energy scales as anticipated, the resulting surge in demand could require two to ten times more dielectric film than the industry currently supplies.

Peak Nano has partnered with leaders like Brückner to meet this demand, leveraging their manufacturing expertise and secure supply chain to rapidly scale U.S.-based production. Our approach aims to reshore the capacitor film industry and bring significant performance improvements to market quickly, retrofitting existing manufacturing lines with our NanoPlex™ film technology. We also plan to provide our advanced film directly to fusion companies who are starting up their own internal capacitor manufacturing to meet fusion's aggressive timelines.

You mentioned that current supply chains are not prepared for the scale fusion will require. What are the most urgent bottlenecks in capacitor film production—and how can the industry address them?

Dr. Michael Ponting: Fusion’s rapid growth represents both a tremendous opportunity and a significant challenge due to current manufacturing infrastructure constraints. As a direct result of demand for fusion, there are now over 70 active fusion machines in development across public programs and private companies. We have already seen rising demand for capacitor film, but also across the entire supply chain, including resin supply, metallization, capacitor assembly, and automation. Much of today’s capacitor manufacturing is manual, and therefore, meeting future needs will require a tenfold increase in capacity, which can only be achieved with major investments and process optimization and automation. While

Peak Nano and Brückner are investing in advanced materials and manufacturing, the entire ecosystem – from resin suppliers to capacitor integrators – must also expand and innovate to meet fusion's needs.

Looking ahead, what kind of innovation or capacity expansion – both in materials and manufacturing – do you believe is necessary to meet the projected demand for capacitor films in fusion energy systems?

Dr. Michael Ponting: Meeting fusion's demand will require innovation and expansion at every stage of the supply chain. The evolution of capacitor film – the workhorse powering the capacitors that will ignite the fusion process and get fusion energy onto the grid – is crucial. We need to produce films that last millions to billions of cycles and withstand harsh environments, high temperatures, and rapid cycling to support the advanced electronics that are integrated into next-generation fusion systems. As film performance improves, it will drive the need for advances in all supporting processes: resin production, metallization, capacitor winding, and fabrication. Ultimately, the success of fusion energy will depend on our ability to deliver these high-performance materials on time and on scale.

We thank Michael and Peak Nano for sharing their insights and expertise. Their forward-thinking approach to capacitor film development and commitment to innovation are truly inspiring. Peak Nano is currently accepting sample requests of Peak NanoPlex LDF from major capacitor manufacturers with demanding applications.

Stay tuned for more expert perspectives as we continue to explore the technologies shaping the future of film production and sustainable energy solutions.

"Powering Fusion": Expert Interview with Peak Nano on the Future of Capacitor Films

As part of our *Expert Interviews*, we are pleased to feature Peak Nano, a U.S.-based leader in nanotechnology used for advanced energy and optics materials. With a strong foundation in capacitor film innovation and a growing portfolio of nanolayered metamaterials, Peak Nano is helping to shape the future of high-performance energy systems.

In this interview, we speak with **Dr. Michael Ponting**, Chief Scientific Officer at Peak Nano, about the company's role in supporting the emerging fusion energy sector. We explore how capacitor films are enabling pulsed power systems, what challenges lie ahead for scaling production, and how strategic partnerships – including with technology providers like **Brückner** – are essential to meeting the demands of next-generation fusion reactors.

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About Peak Nano

Peak Nano's NanoPlex™ films are powering the next generation of energy and national security. As the new industry standard in high-performance capacitor films, specialty films, and optics, Peak's custom films are composed of nanolayered materials that deliver unmatched thermal endurance, efficiency, and reliability. With 20+ global patents, our NanoPlex™ solutions integrate seamlessly as a plug-and-play replacement for legacy BOPP – modernizing critical systems and solving limitations across the power grid, fusion, EVs, aerospace, and defense. Proudly manufactured in the U.S. with secure supply chains from allied nations, Peak's films and optics are unlocking the potential of critical U.S. industries and infrastructure.

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