

NANOPLEX



TECH BRIEF | 

WHAT IS NANOPLEX™



4000 NANOLAYERS INTO A SINGLE METAMATERIAL

INTRODUCTION TO NANOPLEX

- NanoPlex is the foundational nanoscale metamaterial technology for Peak products and solutions.
- NanoPlex is the outcome of over 20 years of efforts by researchers from DARPA, NRL, Case Western Reserve University, and the DOE, jointly developing the technology.
- NanoPlex's translucence is a unique capability that enables Peak to produce the industry's first LGRIN lens optics applications.
- NanoPlex has revolutionary energy storage capabilities ideal for applications like pulsed power, EVs, power management, and Fusion energy.
- NanoPlex's nanoscale properties lead to more compact solutions and reduce the size and weight of everything made with this metamaterial.
- Over 20 global patents protect Peak's technology.
- NanoPlex's nanoscale technology enables Peak to solve macroscale global problems.



AN INTRODUCTION TO NANOPLEX™

An Introduction to NanoPlex

NanoPlex is a family of nanoscale (1 billionth of a meter) metamaterials that can be programmed to enhance performance in a variety of applications, including optics, energy storage, product packaging, and protective films, to name just a few.

What is a Metamaterial?

Metamaterials are artificially engineered materials designed to have properties not found in naturally occurring substances. They are created by arranging materials in specific configurations at a nanoscale, often smaller than the wavelengths of light, sound, or electromagnetic waves. This gives them properties to create new products and solutions that have never existed.

What is Nanolayered Technology?

Nanolayered technology involves the creation of materials composed of extremely thin layers, typically on the nanometer scale (1 to 100 nanometers in thickness). These layers are stacked or deposited on top of one another to form a structured metamaterial. The controlled composition of these nano-thin layers allows for manipulating material properties, leading to unique functionalities and enhanced performance in various applications.

These nanolayered materials can be engineered precisely, altering their optical, mechanical, electrical, or chemical properties by changing the layers' composition, thickness, or sequence. This level of control at the nanoscale enables customization of bulk properties, such as increased strength, improved conductivity, enhanced catalytic activity, or specific optical responses.

Nanolayered technology finds applications in diverse fields, including advanced coatings, power grids, Fusion energy, optics, and biomedical devices. The precise manipulation of properties at the nanoscale offers new opportunities for innovation in various industries.

How is Peak Applying NanoPlex?

NanoPlex can bend light in new ways, which enabled Peak to invent LGRIN (Layered Gradient Refractive Index) optics, supercharging pulsed-powered solutions for power grids, fusion energy, EVs, plus protecting satellites and other aerospace applications from solar radiation and managing solar reflections. This is just the beginning of how NanoPlex can use nano-scale technology to solve macro-scale problems at home, in orbit, and across the galaxy.





HISTORY OF NANOPLEX

Company Data

2002 - CWRU presents the first draft of NanoPlex

2002 - Naval research meets CWRU, and the LGRIN concept is created

2005 - CWRU/NRL Conceived the layered capacitor concept

2006 - NSF grant to CWRU drive NanoPlex R&D

2008 - ONR support 6.1 capacitor film research

2010 - Founding of Polymer Plus

2012 - ONR SBIR phase 1 for dielectric film development

2013 - NSF grant for film capacitor parts

2013 - ONR phase II SBIR award for dielectric films

2015 - DARPA and DOE awards for EVs and film capacitor parts

2016 - Peak acquires Polymer Plus

2017 - Multilayered dielectric film scale-up coextrusion trial

2021 - \$40M buildout of Optics and Film Foundries in Ohio

2023 - DoE Fusion reactor announced

NanoPlex - Our Foundational Technology

NanoPlex is a metamaterial that is engineered for many use cases. For example, we make over 800 versions of NanoPlex to build our HawkAI lens formulations. While there are other nanolayered metamaterials manufacturers, we are differentiated from them in four ways:

- 1 | **Thousands of Metamaterial Layers**- NanoPlex can stack over 4,000 nanolayers into a single metamaterial. This ability is world-leading.
- 2 | **Predictable Layer Integrity** - Peak can engineer and manufacture NanoPlex with predictable and consistent layer integrity. This provides exceptional differentiation and competitive advantage, vital for our core applications.
- 3 | **Engineered Translucence** - NanoPlex's ability to maintain translucence when combined into a metamaterial is unique in the market. This is why Peak is the only company that can build HawkAI LGRIN lenses today.
- 4 | **Nano Management of Nature** - NanoPlex can change how we define what a material is and what a material can accomplish. Our ability to bend and block light, sound, and electromagnetic waves, conduct or insulate electricity, and control atmospheric packaging conditions has never existed.

We are only at the beginning of the NanoPlex journey. Today, we are applying NanoPlex to optics, pulsed power capacitors, and advanced packaging solutions. However, as we advance along our roadmap, Peak will be able to continue to innovate, partner, and discover new uses for NanoPlex for decades to come.

NanoPlex Research Partners

