HAWKAI

peak

TECH BRIEF

WHAT IS HAWKAI™ LGRIN

UP TO 2x THINNER LENSES

Introduction to HawkAI

- NanoPlex is the foundational metamaterial technology for Peak's optics products and systems.
- LGRIN reflects over 20 years of efforts by researchers who jointly developed the technology from DARPA, NRL, Case Western Reserve University, and the DOE.
- Our AI-driven design software enables Peak to reduce design time from years to months, creating a sustainable competitive advantage.
- NanoPlex's translucence is a unique capability that enables Peak to produce the industry's first LGRIN lens optics applications.
- HawkAI lenses are up to 2x thinner and 50% lighter than traditional glass optics.
- HawkAI lenses optimize optics performance across the field of view, color clarity, and distance.
- Over 20 global patents protect Peak's technology.
- NanoPlex's nanoscale technology enables Peak to solve macro-scale global problems.

HAWKAI™

AN INTRODUCTION TO HAWKAI™ LGRIN TECHNOLOGY

The History of Gradient Refractive Index (GRIN)

NanoPlex is a family of metamaterials that can be programmed to meet various applications, including optics. The fundamental concepts and mathematics for GRIN (Gradient Refractive Index) were invented by James Maxwell (1831–1879), who formulated a set of equations known as Maxwell's equations. In the 1950s, Harold Hopkins and Narinder Kapany pioneered the use of multiple thin glass lenses to correct optical aberrations in high-quality imaging systems. This work contributed to the foundation of what would later become gradient index optics. In the early 1970s, Duncan Moore and John Yoder made additional advancements in the understanding and practical application of gradient index optics. Their work paved the way for commercializing GRIN optical devices and systems for fiber optics and other specialized applications.

The Genesis of LGRIN Lenses

In 2002, teams from Naval Research Lab (NRL) and Case Western Reserve University (CWRU) met (including Peak's Mike Ponting and Rich Lepkowicz) at a conference. The CWRU team was working on the precursor to NanoPlex, and the NRL team was working on GRIN and other optics programs. After that meeting, the idea of LGRIN was born. The ability to bring together the many translucent layers of NanoPlex and apply them to the optical models of GRIN led to the invention of LGRIN technology used in our HawkAI lenses.

NanoPlex – The Translucent Metamaterial

One of the most revolutionary capabilities of NanoPlex is the ability to engineer translucent metamaterials. For virtually every naturally occurring material that is clear in a single layer, their inherent refractive indexes will cause them to turn opaque when they are layered together. Maintaining translucence makes NanoPlex a unique metamaterial. We can mix thousands of layers and still produce the translucent metamaterial required to design and produce our HawkAI lenses.

History of HawkAI LGRIN

2002 – CWRU presents the first draft of NanoPlex

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

2004 – DARPA optics research to re-create biological optics abilities

2006 – Fixed LGRIN is proven to be viable and manufacturable

2006 – CRWU receives an NSF grant to develop LGRIN

2010 – Founding of Polymer Plus to create manufacturable LGRIN

2016 – Peak acquires Polymer Plus

2020 - First major Army development funding for LGRIN

2021 - $40M build-out of Optics and Film Foundries in Ohio

2022 - First products identified for optical tech by DoD

2022 – Development of Peak's AI-based HawkAI software

2023 - First products identified for optical tech by DoD

2024 – First HawkAI product shipments to the Army

HawkAI – The AI-Based Optics Revolution

Today, we have over 800 versions of NanoPlex that can be used to build our HawkAI lens recipes. No other company has our AI-based design software to combine these NanoPlex layers in lenses, but our leadership continues beyond the patented technology. Our advanced manufacturing, shaping lens curve layers, and diamond-turning the lens to prescription processes are world-class and represent another competitive advantage almost impossible to replicate for optics. Here are five ways HawkAI lenses are differentiated from any other optics on the planet:

1 **Unparalleled Optics Performance** – Layered Gradient Refractive Index (LGRIN) technology improves the field of view (FOV), color clarity, and distance of optics for night vision goggles, fire control systems, and UAS reconnaissance.

2 **AI Optics Design** – Peak invented a new class of mathematics based on Maxwell's equations and created patented AI-based design software.

3 **Engineered Translucence** – Our manufacturing processes and systems are the most advanced and precise in the optics industry. Our diamond-turning process can remove layers as small as two molecules of thickness.

4 **Lenses Shaping and Diamond Turning** – The core metamaterial of our HawkAI lenses is our patented translucent NanoPlex. This is why we are the only company that can build HawkAI LGRIN lenses today.

5 **100% US-based IP and Design** – The intellectual property and design software for Peak's LGRIN lenses, NanoPlex meta-materials, and manufacturing process are protected by over 20 patents. The research and engineering teams and manufacturing facilities are US-based.

We are only beginning the HawkAI optics journey today. In the future, we can apply this technology to any optics applications, including surgical equipment, cameras, and many other solutions. Peak will be able to continue to innovate, partner, and discover new uses for NanoPlex for decades to come.

Peak Nano Optics, LLC
8190 Roll & Hold Parkway
Macedonia, OH 44056

PNOSales@peaknano.com
www.peaknano.com
+1 216.750.8673