

Modendo fixes the blind spot inside AI chips

For deep-tech hardware startups, commercialization often requires an agile willingness to follow a technology wherever the market demands. Modendo Inc. was originally founded and incubated in Boulder, Colorado to develop hair-thin fiber-optic microscopes designed to look deep inside delicate brain tissue for neuroscience research. However, when semiconductor manufacturers approached the team with the need to inspect microscopic, tightly confined spaces inside advanced electronics, the startup discovered a massive, unserved market.



Modendo CEO
Antonio M. Caravaca
Aguirre, PhD

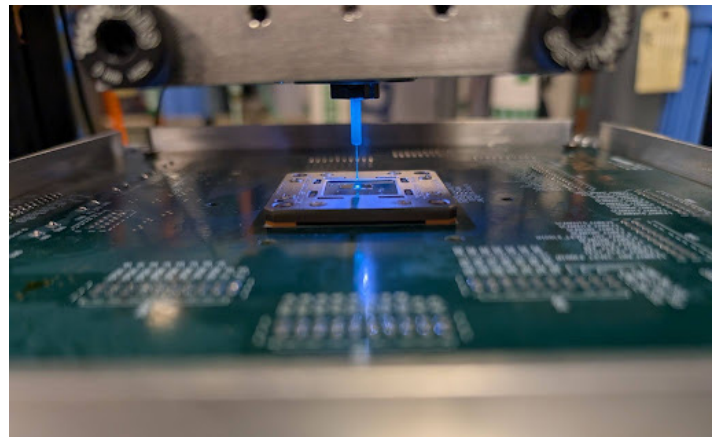
To make the transition from bio-science to semiconductors, Modendo recognized its team could benefit from the concentrated knowledge of a large, established optics ecosystem. After searching for support, Modendo applied to Luminate NY in Rochester. As the world's largest accelerator for startups working on technology enabled by optics, photonics, and imaging (OPI), it gave Modendo immediate

access to specialized commercialization resources, plus an initial \$100,000 investment.

"Luminate stood out because it offers the exact type of optical hardware expertise we need for our development roadmap," says Antonio Miguel Caravaca Aguirre, PhD, CEO of Modendo. "The program brings together mentors, investors, and operators who all speak the language of advanced optical physics, which is rare. For us, gaining access to that collective knowledge is just as valuable as the funding itself."

As an added benefit, Modendo's arrival in Rochester has placed them squarely within the NY SMART I-Corridor. This federally designated tech hub spanning Buffalo, Rochester, and Syracuse is poised to become the fastest-growing semiconductor ecosystem in the United States. Connecting over 100 organizations—including major supply chain firms and Mi-

MODENDO | See Beyond



Modendo's ultrathin fiber-optic probe—just 100 microns in diameter—imaging and probing a chip under test,

cron's central New York megafab—the initiative provides a powerful, unexpected commercial runway for Modendo as they bring their new semiconductor inspection processes to market.

This strategic alignment positions Modendo to address a severe problem at the absolute forefront of chip manufacturing.

THE MULTI-BILLION-DOLLAR CRISIS IN MODERN SILICON

As tech giants race to build more powerful AI chips, traditional silicon manufacturing techniques are hitting physical limits. To solve for these, chip designers are adopting two new hardware architectures: advanced 3D packaging, which stacks multiple specialized microchips vertically like a skyscraper; and backside power delivery (BSPD), which moves the massive network of electrical power wires underneath the transistors instead of placing them on top.

While these design changes drastically improve computing speeds, they completely bury the microchip's

most critical components. This creates a visibility challenge for engineering teams trying to isolate and analyze hardware failures. Standard chip-inspection instruments—such as conventional free-space lasers and optical microscopes—require a straight, unobstructed line of sight to function.

Because these legacy tools cannot see through dense layers of metal and stacked chiplets, engineers cannot safely inspect or debug the hardware when something goes wrong. When a microscopic manufacturing defect cannot be located, design timelines stall, product roll-outs slip, and low factory yields end up costing semiconductor companies billions of dollars in lost revenue.

SHINING A LIGHT ON DEFECTS

To break through this physical barrier, Modendo takes a radically different approach to micro-inspection. Instead of trying to look at a dense chip architecture from the outside, the company's technology carries light directly to the defect. The startup has engineered an industry-first platform utilizing flexible, proprietary fiber-optic probes that are thinner than a single strand of human hair—measuring less than 100 micrometers in total width.

This flexible probe functions as a high-resolution, micro-scale microscope that can navigate through tightly confined spaces. It delivers laser light directly to buried transistor layers through microscopic, 100-micrometer access holes drilled into the packaging. This allows engineers to perform Laser Assisted Device Alteration (LADA)—a critical industry test that isolates faults by using lasers to interact with the circuitry while the microchip is actively running—without destroying the fragile surrounding components.

By delivering light directly to the target area, the technology provides a completely non-destructive inspection path that preserves defect evidence. This workflow is ideal for semiconductor companies, failure-analysis labs, and advanced R&D teams developing next-generation chips.

MULTIPLE MARKETS, MULTIPLE REVENUE STREAMS

The core technology was originally developed over a decade ago in academic labs as an ultrathin neuroscience endoscope. A year ago, Modendo began commer-

cializing the platform to map deep brain regions with minimal tissue disruption.

"The most important information is often hidden in places that are extremely difficult to reach," explains Caravaca-Aguirre. "Our hair-thin probe is specifically engineered to solve this universal access problem, effectively clearing the blind spot inside these complex devices. While next-generation semiconductors represent our most urgent commercial focus, microchips are just one area where our innovation can be applied."

With its broad, adaptable platform, Caravaca-Aguirre believes the technology also can be deployed in adjacent material sciences markets. Over the long term, Modendo has plans to leverage its experience in biomedical and deep-brain neuroscience to support these applications as well.

SUPPORTING THE LEAP TO PILOT DEPLOYMENTS

In the immediate future, Modendo will work with Luminate to deliver its first pilot systems to early customers.

"We're focused on validating Modendo's technology in real semiconductor failure-analysis workflows and showing that ultrathin optical probing can help engineers solve access challenges in next-generation chips," shares Caravaca-Aguirre. "This period is about converting our technology into a customer-tested product and building the foundation for commercial growth."

The company also hopes to secure additional capital at the Luminate Finals on September 30. Receiving a portion of \$2 million in follow-on funding—provided by Empire State Development's Finger Lakes Forward Upstate Revitalization Initiative—will accelerate Modendo's commercial traction.

"To scale your business, you have to grow your team. If we win Finals, we'd hire specialized technical roles," Caravaca-Aguirre adds. "The right team is what can turn a promising platform into a product customers depend on."

Caravaca-Aguirre acknowledges that turning an innovation into a multi-market solution requires the right industrial ecosystem, too. "Luminate has provided commercialization resources we simply could not find at home. These regional connections are directly supporting our path from prototype to pilot deployments."