



amorphyx.com

PO Box 2821  
Corvallis, OR 97339  
[info@amorphyx.com](mailto:info@amorphyx.com)

John Brewer  
CEO and President  
+1.503.453.2765  
[jbrewer@amorphyx.com](mailto:jbrewer@amorphyx.com)

## AMORPHYX

REINVENTING THE DISPLAY BACKPLANE BY  
ELIMINATING SEMICONDUCTOR CONTENT

SIMPLIFYING MANUFACTURING,  
REDEFINING COST

ADVANCING ULTRA-HIGH RESOLUTION,  
INCREASING ENERGY EFFICIENCY,  
INTEGRATING TOUCH,  
AND ENABLING FLEXIBLE SUBSTRATES

## OUR MISSION

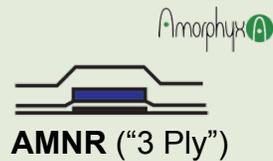
Amorphyx is an innovator at the intersection of materials science and electronics for the display market. We leveraged our expertise in amorphous metals and the creation of high-quality thin films in developing the Amorphous Metal Nonlinear Resistor (AMNR) device, subpixel circuit, and PECVD-based manufacturing process. The AMNR simplifies backplane processing and reverses the trend of increasing complexity and cost in the TFT-LCD.

## WHY AMNR MATTERS

The demands on backplane performance from the coming generation of displays – faster switching speed, ultra-high resolution, touch-display integration, lower power consumption – have driven TFTs to more complex materials systems and structures. **More complex TFTs lead to more complex manufacturing processes, lower yields and higher backplane costs.** In an industry where TV, laptop, tablet and smartphone prices decrease much faster than display manufacturing costs, **more complex TFTs lead to even higher losses per display module.**

Amorphyx's thin-film-based amorphous metal nonlinear resistor (AMNR) **delivers increased backplane performance at nearly half the manufacturing cost of a-Si TFTs.** The AMNR is a tunneling device fabricated with metals and insulators, **eliminating backplane semiconductor content and decreasing backplane process complexity.** Operating on the principle of Fowler-Nordheim current tunneling, the AMNR is constructed of three thin films: a sputtered amorphous metal lower electrode, an aluminum oxide insulator grown using PECVD, and a sputtered ITO top electrode.

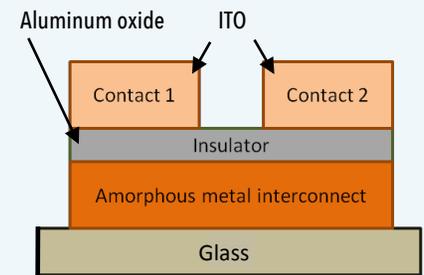
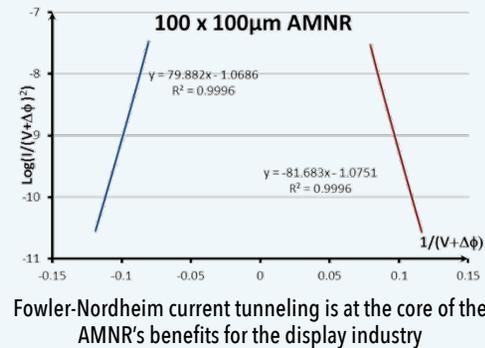
Simple materials, a simple device, simple manufacturing process, and a subpixel circuit based on differential techniques – **a simple path to increasing backplane performance while reducing cost.**



**SIMPLE DEVICE**  **HIGH PERFORMANCE**  
**LOW COST**  **FLEXIBLE**  **TOUCH**

## ADVANTAGES OF THE AMNR

- Three lithography masks, two PECVD process steps (insulator, passivation)
- No sensitivity to light, minimal sensitivity to temperature
- Differential AMNR subpixel circuit eliminates display-scale uniformity issues
- Simple AMNR structure supports fast switching speeds, reduced power consumption resulting from reduced control voltage range
- Supports increased display resolution, increases aperture ratio



## OUR OPERATIONS

**Amorphyx manages two member-funded consortia** for commercializing its AMNR backplane technology in partnership with display manufacturers, backplane equipment vendors, flexible substrate suppliers, and subpixel and interconnect materials developers.

In the R&D Center, **Amorphyx and Member display manufacturers work as a group in optimizing AMNR-based subpixel circuits and AMNR device scaling** for specific display requirements.

**Display manufacturers join with backplane manufacturing equipment vendors and Amorphyx as Members in the Manufacturing Consortium** to tailor the AMNR manufacturing process for specific LCD and flexible display production techniques. Amorphyx supports each process into the Member's production facility while providing ongoing production support.

## OUR TEAM

**CEO John Brewer** is a seasoned startup veteran, having spent nearly 25 years in the wireless communications semiconductor industry, with seven startups including two university spin-outs. He most recently was a Vice President with SiGe Semiconductor, where he helped revive the company from near-failure and lead the company's 2011 IPO registration on NASDAQ before being acquired.

**CTO Dr. Bill Cowell** spent 17 years in quality assurance and process transfer in the Intel "silicon mines" before earning the MS and PhD in Electrical Engineering from Oregon State University. His thesis on amorphous metal vertical non-ohmic conduction electronic devices is the foundation of Amorphyx's technology.

**BoD Dr. Doug Keszler** is a Distinguished Professor of Chemistry at Oregon State University, and is currently the Director of the Center for Sustainable Materials Chemistry. With colleagues at OSU, he contributed to the development of the first transparent oxide thin-film transistor and co-authored the book *Transparent Electronics*.

**BoD Michael Phillips** is Senior Counsel with Morrison Foerster in its Palo Alto office. He has been a business lawyer in Silicon Valley for more than 30 years, representing public and private companies in all phases of their capital raising, commercial relationships and liquidity transactions. He specializes in the financing and structuring of start-up and other emerging businesses, mergers and acquisitions, and complex strategic partnerships and joint ventures, with emphasis on technology licensing.

**BoD Richard Warren** retired from IBM in 2010 where he spent the last 13 years of a 25-year career at the Vice President level in the Systems and Technology Division. He managed the integration of multiple acquisitions, and created and led a global organization in storage and software solutions. In addition to his IBM career, Rick has served as a co-Chair of Oregon's Signature Research Committee and Chair of the Key Industries Committee for the Oregon Innovation Council. He continues to serve Oregon InC as a Technical Advisor.

## OUR FOCUS

- **Replacement of the TFT in LCD backplanes**, dramatically reducing cost while enabling energy savings and supporting increasing resolution across the full range of display segments
- **Integration of touch and display functions** into a single backplane circuit, driving down cost while increasing touch performance
- Development of a flexible glass-based LCD backplane that **redefines the display supply chain through creating a stand-alone component** to be shipped to display manufacturers

## STATUS

### Technology

- Validated the AMNR for production on flat glass using existing TFT-LCD plasma-enhanced chemical vapor deposition (PECVD) and sputter techniques.
- Optimizing AMNR structure and performance for LCD applications
- Developing AMNR process for deposition on flexible glass substrate
- Created AMNR subpixel circuit, device models for SPICE-based computer-aided backplane design simulation platforms

### Commercial

- Initial engagements with range of market leaders in
  - Display module production
  - Backplane manufacturing equipment
  - Mobile device reference designs
  - Flexible glass substrate producers

### Funding

- University, State and Federal grants; private investor convertible note; secured line of credit for development lab capital equipment