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CHASM Advanced Materials Preferred Integration Partner Program

Creating Value and Growth

The ITO Alternative: A new class of transparent
conductive film to accelerate your business.





Market Needs Evolve

“There are people who make things happen, there are people who watch things happen, and there are people who wonder what happened. To be successful, you need to be a person who makes things happen.”

- Jim Lovell, NASA Astronaut

Technology doesn't just accelerate innovation of new products, it also accelerates their maturation and eventual demise. The same phenomenon is currently playing out for transparent thin film conductors. Initially revolutionary for its combination of electrical conductivity and optical transparency, successfully applying indium tin oxide (ITO) to the cutting-edge industrial design trends for sculpted electronics and growing prevalence of flexible displays is proving increasingly challenging.

A newly emerging class of CNT hybrid films is rivaling the incumbent’s electrical conductivity and optical transparency while simultaneously delivering flexibility, environmental stability, and economy of manufacturing beyond ITO’s reach. Even when compared to the full range of ITO alternatives, CNT hybrid films offer performance advantages to become *the ITO alternative* of choice for many companies looking to stay ahead of the market demand curve when launching their next innovative electronic product.

Comparing ITO Alternatives

Several TCF material categories have been introduced to the market, each with limited commercial traction. Comparing the properties or costs associated strictly for the films would be far from representative and inconclusive at best because there are widely varying costs associated with producing the final patterned circuits. Additionally, properties inherent to a particular film can make them more or less susceptible to handling damage during manufacture or may necessitate additional processing for environmental reasons.

	PEDOT	AgNW	MM	CNT	CNT Hybrid
Optoelectronic Performance					
FPC Patterning Cost					
Environmental Stability					
Flexible / Formable					

Compositionally, ITO is a ceramic, making it brittle and susceptible to cracking when flexed. As many product designs are moving towards thinner, flexible and 3D-shaped form factors, this represents a huge limitation. ITO does have excellent optoelectronic properties, but these are contingent upon the temperatures that can be safely reached during the vapor deposition process. The higher temperatures possible on rigid glass substrates contributing to those optoelectronic properties are not achievable on plastic films due to the temperature limitations of the plastic substrates.

Finally, circuit patterning of any ITO alternative deserves serious consideration as it can add substantially to overall costs. Circuit patterning on flexible plastic films can be expensive either due to handling damage which increases in probability as the circuit area becomes larger or due to the patterning method required for that substrate.

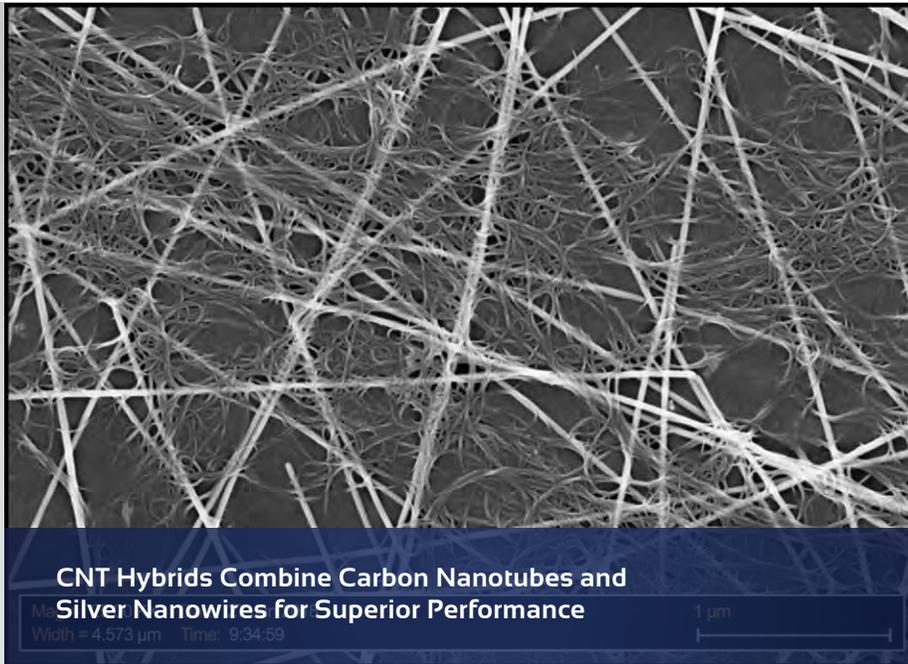
One common patterning method for circuit creation is photolithographic etching. The process steps include applying the etch mask, develop, etch, capture/treat the etch waste streams, strip off the etch mask, then finally clean the circuit. This amounts to quite a few steps with materially significant costs both in terms of dollar value and manufacturing process time.

Another common circuit patterning method is laser ablation. For this process, a laser is used to vaporize unwanted material but care must be taken not to damage the underlying substrate. The material properties of glass make it more durable for laser ablation with flexible films being more susceptible to damage. The risk of damage from laser ablation also increases with the amount of material requiring removal. Resulting circuit areas representing only 15% of the total area will require ablating 85% of the area. That can represent a significant amount of time on the laser, increasing the chance for damage to a substrate of plastic. Even with a touch screen having an X and Y diamond pattern, ablating as much as 50% is required. These costs can add up. Conservative estimates put the cost of this patterning at triple the cost of the ITO film alone. Put another way, if you are buying patterned ITO, it can be up to 4X the cost of buying the ITO film alone. As product designs are moving towards thinner and larger area substrates, the challenges, costs and risks of chemical or laser patterning are further compounded.

CHASM Printed CNT Hybrids

CHASM's new TCF category combines existing technologies to create a hybrid solution substantially superior in performance. By combining CNTs with either AgNW or MM, this novel category of CNT hybrid overcomes the limiting factors of CNT, AgNW or MM technologies alone.

A simple way to appreciate the composition of a CNT hybrid and the elegance of this category is to begin by visualizing the structure of AgNW while considering the limitations previously discussed. As shown in the following image, the light-colored silver nanowires form a lattice-like matrix when coated onto film. The matrix of interconnected wires provides good conductivity, but the density of the matrix and wire diameter impede transparency through haze. Creating a coarser matrix or using smaller diameter wires would improve transparency,



but conductivity would suffer. But even after suitable optoelectronic performance is achieved, this still leaves the environmental issue of silver's propensity to tarnish.

A CNT hybrid combines a matrix of carbon nanotubes – the darker webbing in the image above – providing conductive redundancy so higher optical transparency can be achieved with low sheet resistance. The conductive CNTs also encapsulate the silver nanowires providing environmental stability without acting as an insulator. And since a polymer top coat is not required, the process of creating patterned TCFs is simply; print, etch, and done.

A CNT hybrid using MM similarly offers substantive advantages over the standalone film. Achieving sufficient transparency with MM requires having at least 90% of the area has to be open – so you end up with big spans of no conductor giving you a very nonuniform electrode surface. To put that in perspective, with lines that are 30 microns wide would require openings that are 500 microns to achieve 90% open. With a CNT hybrid, a matrix of carbon nanotubes completely bridges across those openings, now rendering them conductive. Additionally, the matrix of CNTs sitting atop the narrow MM wires provides redundancy so that if they were ever to break or separate even in multiple locations, the CNTs would bridge across those breaks providing resiliency to the circuit.

A Partnership Opportunity to Both Land New and Upsell Existing Clients

The CHASM Preferred Integration Partner Program (PIP) is designed to incentivize and reward select business partners for CHASM products with the goal of driving revenue growth and market penetration mutually for both organizations. Exclusively offered to companies with an existing customer base and demonstrating expertise at integrating flexible printed electronics into finished product or electronic assemblies, PIP members enjoy numerous benefits including preferred pricing, go-to-market and technical support, training, and more. CHASM products offer an innovative and novel platform to both land new clients as well as upsell existing clients for PIP members eager to strategically engage with both CHASM and the marketplace.

Program Levels

Whether regionally focused or globally distributed, the CHASM PIP Program offers partnership categories to fit your strategic business objectives in all market segments. Regardless of your area of expertise, there's a CHASM PIP Program level to fit your needs and provide an opportunity to grow your business.

As CHASM PIP partner, finding a role at the level of commitment that's best for your business is easy and can grow over time. Available levels include Bronze, Silver, and Gold to support everything from local, industry-specific collaborations to far-reaching global alliances covering multiple geographies and industries. Each level includes a range of features and benefits all backed by dedicated CHASM professionals delivering marketing and sales support, technical and production services, training, and CHASM AgeNT™ certification opportunities. The table below highlights benefits associated with the program partner levels. Contact PIP Program representatives or one of our Business Development Directors to learn more.

CHASM PIP Benefit	Bronze	Silver	Gold
Dedicated logo presence on CHASM website cross-linked increasing search visibility including "bronze certified" CHASM PIP badge	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Active promotion of partnership including press announcement	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Active promotion of joint wins including press announcement	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Active promotion of bronze certification including press announcement	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

CHASM PIP Benefit	Bronze	Silver	Gold
Sales ready leads based on partner capabilities	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Joint sales calls		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Active lead sharing at a regular frequency		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
CHASM website presence includes "silver certified" PIP badge and "contact partner" form		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Active promotion of silver certification including press announcement		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Technical certification on AgeNT materials		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Opportunity to participate in CHASM sponsored events		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Proactive promotion in CHASM newsletter		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Joint sales calls plus CHASM sponsored seminars/lunch & learn			<input checked="" type="checkbox"/>
Dedicated advertising campaigns for partner assigned leads			<input checked="" type="checkbox"/>
CHASM website presence includes "gold certified" PIP badge and dedicated advertising campaigns			<input checked="" type="checkbox"/>
Active promotion of gold certification including press announcement			<input checked="" type="checkbox"/>
Dedicated presence in CHASM events (trade shows & webinars)			<input checked="" type="checkbox"/>
Proactive promotion in CHASM newsletter, social media and individual offers to CHASM audience			<input checked="" type="checkbox"/>

Benefits

CHASM PIP members can flexibly choose from a full range of activities to meet their go-to-market objectives. Benefits include:

- Dedicated CHASM strategic relationship manager
- Member-specific sales and technical training including joint sales calls
- Priority access to CHASM executives
- Marketing support & co-marketing opportunities for improved sales funnels
- Early visibility to CHASM product/IP roadmap and ability to shape direction for PIP member's benefit

- Referral opportunities when providing a capability for a customer's specific needs
- Exposure to CHASM's community of corporate end users across industries
- Joint press announcements with promotion in CHASM's media distribution:
 - Recognition as a PIP member
 - Collaborative wins
 - Certification levels
- Listing as a PIP member on CHASM's website with cross linking to drive SEO ranking
- Use of the CHASM PIP brand mark in partner's collateral, correspondence, and website
- Joint development of co-branded assets such as white papers and case studies
- Eligibility to co-present in a live CHASM promoted webinar plus hosted as a video for on-demand viewing on www.chasmtek.com
- Eligibility for CHASM participation and support for a partner hosted webinar including a CHASM subject matter expert as co-presenter, promotion to CHASM opt-in list, and availability to link webinar recording on www.chasmtek.com

Key Advantages

Product Discounts – CHASM PIP members receive exclusive discounts on and priority shipment of CHASM's product offerings.

Concierge Technical Support – Avoid downtime and maximize yield with access to CHASM's industry leading expertise in transparent flexible printed circuit production.

Lead Referral Program – CHASM will provide inbound leads to PIP members as appropriate based on geographical coverage and partner capabilities. Leads will range from early funnel to highly qualified with no guarantee on quantity or quality.

Co-marketing Programs – Based on PIP member performance, CHASM will contribute personnel, resources, expertise, and/or funds to PIP members that promote CHASM products.

Co-branding Collateral – CHASM will provide camera-ready electronic co-branded collateral to PIP members at no cost for use in sales and marketing activities.

Sales and Technical Training – CHASM offers a range of in-person and self-paced training to PIP member teams to insure they are fully knowledgeable on CHASM products and have the sales tools necessary to drive revenue growth.

Discounted CHASM Product Demo Kits – PIP members are eligible to purchase at a discount-

ed rate CHASM standard demo kits highlighting a variety of industry applications, valuable as sales and marketing tools.

Product and IP Roadmap Updates – PIP members receive “sneak peek” insights into new products and IP developments by CHASM, plus the opportunity to provide feedback and enhancement requests on product improvements benefiting the partner’s business. With updates provided by the CHASM executive team, PIP members receive valuable insights into the state of the industry, new CHASM initiatives, and leading developments from recognized industry experts.

Joining the CHASM PIP Program

The CHASM PIP program is gateway to both landing new business and expanding your customer base. Joining the program is easy using the following steps:

- **Step 1: Apply**
 - Download and complete the [CHASM PIP Program Membership Application](#)
 - Complete initial consultation scheduled by CHASM
- **Step 2: Qualify**
 - Provide additional information as required about capabilities and region
 - Receive CHASM license agreement (if required)
 - Complete all membership requirements
- **Step 3: Sign**
 - Return signed CHASM license agreement (if required)
 - Receive CHASM PIP status
- **Step 4: Onboard**
 - Complete CHASM PIP Program overview training
 - Meet your dedicated CHASM partner support manager
 - Provide partner branding/contact details
 - Receive CHASM PIP Program materials
- **Step 5: Grow**
 - Participate in program level benefits
 - Engage with CHASM personnel to create new sales opportunities
 - Leverage CHASM promotional channels to drive more business

Requirements

Membership in the CHASM Preferred Integration Partner Program is offered exclusively to companies not just having an established customer base for flexible printed electronics but also those demonstrating leading expertise at integrating flexible printed electronics into finished product or electronic assemblies. PIP member companies represent the “go-to companies” in the industry, offering their customers extensive integration capabilities and consultative expertise on the latest innovations in the industry. Eligibility requirements for the PIP program include:

- Commit to signing the CHASM Preferred Integration Partner Program Agreement
- Maintain at least one sales representative dedicated to the PIP Program
- Dedicate time for sales staff to participate in CHASM training and PIP programs
- Actively promote CHASM products to existing customers and new prospects
- Make CHASM products visible, searchable, and prominent on your website
- Secure customer case studies produced by CHASM
- Proactively strategize with CHASM quarterly on marketing and revenue generation
- Consistently deliver revenue growth year over year

Advanced tiers of the CHASM PIP program have additional requirements as follows:

CHASM PIP Tier Requirement	Bronze	Silver	Gold
Certified to fabricate FPCs made from patterned Agent layers supplied by CHASM	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Convert one customer using an alternative TCF to CHASM’s CNT Hybrid solution	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Certified to screen print CNT inks supplied by CHASM		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Secure a minimum of 5 successful “design in” wins		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Certified to fabricate patterned Agent layers using CNT inks and AgNW or MM films supplied by CHASM			<input checked="" type="checkbox"/>
Secure a minimum of 10 successful “design in” wins, 2 of which with reoccurring annual volumes			<input checked="" type="checkbox"/>

For more information about becoming a CHASM Preferred Integration Partner, please contact sales@chasmtek.com or call CHASM Headquarters at +1.781.821.0443.

www.chasmtek.com

**Your Solutions.
Our Materials.**

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