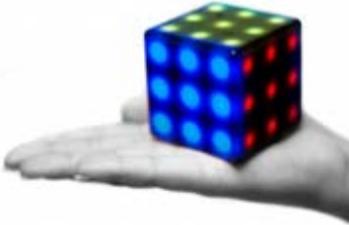




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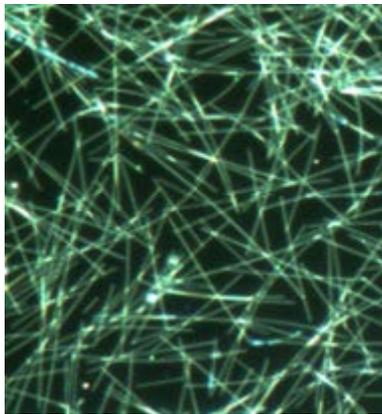
Interview with Paul Herro from Carestream Advanced Materials

Paul Herro is General Manager at Carestream Advanced Materials. Paul has led many successful first of kind market introductions of innovative technology solutions. Prior to Carestream, Paul was Vice President of Product Marketing and Corporate Development for TSI, a global leader in nanotechnology instrumentation. He also was active in Corporate Development activities with TSI's parent, Churchill Industries. Prior to Churchill and TSI, Paul held multiple Product Marketing and Professional Services leadership roles in implementing innovative cardiac clinical information systems for GE Healthcare and Merge Healthcare. He has a Bachelor's of Science degree in Mechanical Engineering from the University of Wisconsin – Milwaukee.



Please give us some background information about Carestream Health. Carestream is an independent dynamic company with over 100 years of technical and innovative leadership in optical films and medical imaging. Our global footprint allows our 7,000 employees to sell products in over 150 countries, achieving revenues of over \$2.4B in 2012. While Carestream's primary business is medical imaging equipment, software and films, Carestream's new Advanced Materials business unit has leveraged our expertise in silver chemistry and our world class precision roll-to-roll coating assets to develop advanced films for markets outside of our primary healthcare market. Our first product is FLEXX Transparent Conductive Films.

Please tell us about the solution you've developed to displace ITO. FLEXX transparent conductive films feature silver nanowire technology solution coated in a high-speed precision roll-to-roll coating process. FLEXX has been designed to enable the future of the touch panel market. Touch capability is being implemented on larger devices such as notebooks and All-In-One PCs; mobile devices continue to require thinner and lower cost touch panel designs; and display manufacturers will require flexible touch screens on their flexible displays. The TCF characteristics necessary to achieve future touch panel designs push beyond the performance limits of ITO.



FLEXX was designed to achieve the performance necessary for touch screens of today AND the future. Additionally, Carestream continues to invest in the FLEXX technology to extend it to future markets. FLEXX is an excellent choice for nascent markets like OLED lighting, thin film photovoltaics, flexible display, and others.

FLEXX Silver Nanowire Film

What advantages does your solution provide, as compared to ITO? The FLEXX product offers:

- Low sheet resistance
- High transmission
- Neutral color
- Flexibility
- Availability

What are the biggest challenges in your efforts to displace ITO? Our objective is not to displace ITO, but rather to enable the future of the touch panel market. Today's touch panel market has developed around ITO. As Carestream, we need to take additional care to educate our customers on the best methods to process FLEXX films on their existing equipment. We have worked extensively to explore process and material compatibility to readily give our customers recommendations needed to minimize any additional investment need to process FLEXX films.

There are a number of other materials that are being proposed as an alternative to ITO. What makes your solution better than the competitive alternatives? FLEXX films feature the best optical properties at low sheet

resistances. Transmission, neutral color, clarity and zero moiré pattern (as with metal mesh offerings) are all excellent at low sheet resistances. Additionally, Carestream has applied our extensive experience in silver chemistry to insure FLEXX films will pass the industry's strictest environmental stability requirements which are problematic for other silver and organic based films. FLEXX films are intended to be a drop-in to the touch panel supply chain. Touch panel manufacturers can use their existing processes to quickly meet the fast-paced demands of their customers like they successfully do today with other film solutions. Finally, Carestream is a complete vertically integrated supplier. We develop our own raw materials, formulate inks, and manufacture our films. Our sophisticated supply chain and logistics organization insures that customers around the globe will be working with a quality, responsive supplier. Our regional dedicated Sales and Field Applications Engineering teams consult directly with our customers to get the most from the unique characteristics of FLEXX films. Carestream has invested significant resources into this effort and is committed to the future.

As compared to ITO, do you plan to sell at a lower price, same price, or higher price? There is a wide range of ITO pricing from ~\$7 / sm to >\$100 / sm, so it is difficult to provide a definitive answer. However, we generally are able to offer lower pricing than typical ITO products.

For close to a decade now, analysts have suggested that as a rare element, indium prices would make alternative transparent conductor solutions attractive. Why is it taking so long for the alternatives to be implemented? Although price is an important consideration the display and touch screen industry, quality and performance generally takes priority in a purchasing decision. Carestream's strategy is to provide quality products that offer performance characteristics ITO cannot achieve. Historically ITO alternatives had inferior performance when compared to ITO. Carestream's FLEXX product can now offer customers improved material performance allowing them to finally implement next generation touch panel designs.

What markets are you focused on in your efforts to displace ITO? Our focus is to enable the future of the touch panel market. Our key primary applications in this area are:

- Large size touch panels
- Single layer, multi-touch touch panels
- Borderless touch panels
- Conformal touch panels
- Flexible touch panels

FLEXX films are also an excellent fit for nascent markets like OLED lighting, thin film photovoltaics, flexible display and others. Carestream is investing today and will continue to expand the core FLEXX technology to apply to these and other markets.

What transmissivity do you claim? (And please explain how you measure transmissivity)... There is always a tradeoff between transmission and conductivity, however our 100 ohms/square FLEXX product in the market today has >99% transmission excluding the substrate. For specifications, we adhere to ASTM D1003 and include the PET substrate in our measurements.

How about resistivity? The first FLEXX films feature a sheet resistance of 100 ohms/square. To achieve lower sheet resistances, FLEXX technology is not process limited like ITO. High quality films ranging from 20 – 100 ohm/sq are also available.

In terms of display brightness, what's the difference between a transparent conductor with 85% transmissivity compared to 92% transmissivity? Vendors quote transmissivity using many different techniques and may or may not consider film surface characteristics that impact the complete film stack. A vendors "high transmission" film may lose significant transmission compared to the quoted original when its surfaces are laminated in a film stack. FLEXX films don't feature such distracting characteristics.

Who manufactures your products? As mentioned, Carestream is a fully vertically integrated supplier. We develop our own raw materials, formulate inks, and manufacture our films. Today, Carestream manufactures over 100 million square meters of high quality medical film. Our world class manufacturing facility in White City, OR has an experienced staff, robust quality processes, sophisticated in-line inspection systems, and advanced on-site analytical instrumentation. All these resources are leveraged in manufacturing FLEXX films. By owning our complete technology and manufacturing, we are insured a high quality product that is not capacity constrained.



Carestream Production Coating Facility - White City, OR

It's reported that ITO suffers as panel sizes grow. Is the same true for your solution? Touch panels require lower sheet resistance the larger the design to achieve an acceptable terminal resistance. The FLEXX product line ranges from 20 – 100 ohms/square making it an ideal solution for all touch panel sizes.

Describe the typical supply chain that your product typically sees on its way to an end product. Carestream supplies FLEXX films to touch panel makers directly. There is no difference between the FLEXX supply chain and the ITO supply chain. Our customers make touch panels for the end device manufacturers. Our customers can continue to meet the needs of their demanding customers as they do today. Supply chain disruption for FLEXX films is non-existent.

Can you imagine any way in which your transparent conductor solution might be used to help enable haptic feedback? Of course. Since the FLEXX product line is inherently flexible, it is ideally suited for haptic solutions that require a flexible TCF.

Tell us how you are received by customers. I am constantly amazed on the level of excitement for FLEXX films. Consistently, customers are looking for a better option than the ITO films they are currently buying. In addition to constant supply worries, our customers are always looking for a high quality supplier that can provide them innovative technology. They are looking for a partner that will be with them as they look to expand their business and address the designs of touch panels for today and tomorrow. Carestream is a new brand in this market. But after learning that Carestream is a highly capable supplier of advanced optical films for the medical market, after learning that Carestream has extensive resources to develop, manufacture, and supply high quality FLEXX films, and after learning about the innovative FLEXX film technology, customers are uniformly very open to working with us.

In terms of your implementation strategy, can you tell us what you'd consider to be a "home run"? We are very pleased we have achieved commercial success already with a number of touch panel makers servicing the mobile phone market. We are confident this initial success will continue and FLEXX films meet customer's needs today. But our longer term strategy includes working directly with touch panel controller manufacturers. When

touch panel controller manufacturers leverage the unique characteristics of FLEXX enable innovative end device designs that are not capable with ITO, we will consider that a “home run”.

Separate from transparent conductors, is there anything you’d like the electronics industry to know about your development activities? FLEXX transparent conductive films are just the first product from Carestream. Carestream will continue to invest into this market to develop innovative solutions that meet the needs of customers today and the foreseeable future. We will continue to leverage our expertise in nanomaterials science and precision roll-to-roll coating to develop high value advanced optical films. We are also active in Corporate Development activities are working to identify unique technology that can leverage our assets, supply chain and logistics, and distribution.

