Welcome to SID/DSCC Foldable Display Market Focus Conference

Thank you for joining the 2019 SID/DSCC Foldable Display Market Focus Conference. We are excited to have you here.

The SID/DSCC Foldable Display Market Focus Conference is the first of its kind event focused on the market outlook and technology developments in the foldable display supply chain. Foldable displays have the opportunity to breathe new life into stagnant markets, increase display demand and blended ASPs and consume a growing share of excess capacity that currently exists in OLEDs. Companies presenting include panel makers, brands, analysts, touch suppliers, polarizer suppliers, colorless polyimide suppliers, hard coat suppliers, cover glass suppliers and equipment suppliers.

GENERAL INFORMATION

Conference Proceedings
Presentations will be available the day of the conference for those presenters who provide permission to do so.

Surveys
We will be sending you an evaluation survey electronically a few days after the conference. We appreciate your candid feedback, which will enable us to continue to improve the DSCC and SID conference experience.

Questions During the Conference
There will be time for questions during our panel discussions and if time allows after each speaker. There will be microphones in the audience to ask your questions. Depending on the time available and the number of questions, we may not be able to respond to all the questions. In that case, please ask your questions to the speaker or panelist during the break.

Networking Opportunities
The Conference is an opportunity for invaluable networking with fellow attendees who share similar interests, concerns and challenges. We encourage you to take advantage of all the breaks, meals and the networking reception following the conference to network with your fellow attendees. The Networking Reception will start around 5:30 and end at 7:30 PM and will include beer, wine and hors d’oeuvres. Please make sure you get a drink ticket from the DSCC front desk.

Registration Desk
The registration desk is open throughout the conference outside the conference room. DSCC staff will be available to answer questions, assist you and ensure that your conference experience is satisfying.
For Media
Please use the following hashtag so that your tweets during the conference can be found by all Display Week attendees: #Displayweek19. In addition, follow DSCC at @DisplaySupply and on FB at @display-supplychain.

Mobile Phones
In consideration of your fellow attendees and our speakers and panelists, please set your mobile phones and other electronic devices to vibrate. Please do not receive or make calls during the conference or in the conference area.

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CONFERENCE AND PRESENTATIONDOWNLOAD SUPPORT:
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AGENDA

8:00
Doors Open
Continental Breakfast Served

9:00 - 10:40
Panel Maker/Brand Session

FlexPai - How We Did It

Dr. Bill Liu
CEO, Royole

This talk includes an introduction to Royole Corporation, an innovator and manufacturer of next-generation human-machine interface technologies and products including advanced flexible displays, flexible sensors, and smart devices. In 2018, Royole has introduced the world’s first commercial foldable smartphone, a combination of mobile phone and tablet with a flexible screen, the Royole FlexPai. Disrupting consumers’ traditional concept of a smartphone, the unit can be used either folded or unfolded, giving it the portability of a smartphone plus the screen size of a high-definition tablet. The FlexPai foldable smartphone is based on Royole’s Flexible+ platform, which can be easily integrated into a variety of products and applications across numerous industries.

Visionox Foldable Display Strategy

Dr. Jianping Chen
Senior Technical Fellow, Visionox

Recently, foldable smartphones have received quite attentions and are poised to shape the smartphone market in the foreseeable future, thanks to the defining form factor—folding/unfolding. A key component that plays a pivotal role in helping the foldable smartphone commercial launch is the Active-Matrix Organic Light-Emitting Diode (AMOLED) display module. In this presentation, we will discuss the AMOLED display technology evolution, from its rigid and flat form, to the various flexible forms, curved, bendable, foldable, androllable formats. A special focus will be on the foldable AMOLED display module, its material’s selection (cover window film, circular polarizer, touch sensor, adhesive, etc.) and system integration (hinge design, UX, App., ergonomics, reliability, etc.), when facing different folding formats, in-folding vs. out-folding. In addition, we will also present Visionox’s flexible AMOLED development status and its path forward.
FlexEnable’s Foldable Display Strategy

Paul Cain  
*Strategy Director, FlexEnable*

**Plastic OLCD: A different approach to foldable displays and mass market applications**

The introduction of foldable phones has made quite a splash this year. But are foldable screens only a prerogative of flagship smartphones, and can other products benefit from folding, either dynamically or statically?

FlexEnable is taking a different approach to foldable with its plastic Organic LCD. OLCD uses high-performance organic thin-film transistors on ultra-thin TAC film, resulting in low-cost flexible displays where the cell can be curved to 10mm, and the backplane and routing can be curved down the 0.1mm. This approach not only enables very tight bend radii, but is also a route to borderless displays.

With its cost-effective scalability to large sizes, and the ease with which it can be cut into shapes including through-holes, OLCD addresses a wide range of market applications beyond flagship smartphones and smart watches. Attend this talk to learn about the unique properties of OLCD and the exciting new product designs it enables.

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Foldable Notebooks - Are They Really Coming?

Thomas Wynn  
*Mobile Client Platforms Premium & Innovation Systems Marketing, Intel Corp, Client Computing Group*

**Foldable OLED Displays and Laptop PCs: Opportunities and Challenges.** Learn about Intel’s views and insights on the opportunities that Foldable OLED Displays can bring to the laptop market and the key challenges for the industry to overcome to capitalize on these opportunities.

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Break

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Analysts Foldable Outlook

Ross Young  
*CEO, DSCC*

This presentation will present the status of the foldable display supply chain. It will cover the challenges in moving from flexible to foldable, the solutions developed so far, where progress still needs to be made and the latest cost, price, shipment and revenue forecasts by application, brand and suppliers.
Mark Fihn
Principal, VeV

The notion of a “foldable display” for the mobile phone market has captivated the imaginations of both manufacturer’s and consumers alike – a novel series of technologies that will fulfill a long-sought dream – how to expand the screen real-estate for a device that is limited to a fixed form factor. Indeed, doubling or even tripling the size of a display in a handheld device is appealing. Display industry analysts are busily trying to monetize the potential of this new foldable display market, generally with great optimism. This presentation, however, will highlight several serious problems associated the notion of foldable displays for the mobile phone market. The presentation will end on a more positive note, highlighting several long-standing advantages associated with the development efforts related to current-generation foldable display technologies.

Linda Sui
Director Wireless Smartphone Strategies, Strategy Analytics

Global smartphone market has been under “pause” status over the past five quarters. No major hardware innovations is one of the major issues behind the soft demand. Will display innovations regrow smartphone market in 2019 and beyond? Does the delay of launching foldable smartphone by Samsung cast shadow on display innovation edge?

12:15 - 1:00
Lunch

1:00 - 5:30
New Materials Enabling Foldable Displays

Hak Fei Poon
Founder and CTO, Nuovo Film

Foldable phones and tablets have attracted major attention as one of the most noticeable changes among recent breakthroughs in mobile industry. However, there still remains several technical issues as we transit from rigid displays into foldable displays. One of the most key challenges is the cover window that matches with foldability of the display and yet maintains excellent scratch resistance and protection for the screen simultaneously. Here we present an innovative coating (Flex-Sapphire) that offers glass-like pencil hardness, wear resistance as well as transparent optical properties. It matches well with silver nanowire based touch panel and presents a viable total stack-up for foldable displays.
Polarizers and OCA

Sergey Fedotov  
*Director, Light Polymers*

Lyotropic Liquid Crystal Materials: The Next Generation Polarizer for Foldable and Rollable Displays

- Demands of Foldable / Rollable displays for Optical Materials
- Technology Overview: Lyotropic Liquid Crystal (LLC) Materials
- Market Overview: Polarizers for Foldable/Rollable OLED Displays
- How will LLC materials impact the future of Foldable/Rollable displays
- Advantages of coatable LLC polarizers vs traditional PVA-based technology

David Kimmel  
*Director of Marketing Displays, Americas, Mitsubishi Chemical*

Clearfit™ Optically Clear Adhesive film for Foldable Displays  
In traditional display devices, the critical contribution of optically clear adhesives (OCA) is to increase contrast by mitigating light loss at the interfaces between the display and the cover lens. The secure, weatherable bond of high performance adhesives also supports the environmental and drop resistance of today’s rugged smartphone enclosures. Foldable display devices present numerous challenges for the OCA. First, the adhesive must survive the extreme stress of the folding mechanics over an increasingly broad range of use temperatures with flawless optics and bond integrity. Second, there are considerations of electrical and chemical compatibility with the device touch sensor and adjacent film layers. Third, the material is expected to contribute synergistically to the drop and impact resistance of the enclosure and display stack, while maintaining a minimum thickness profile.

As a world leading vertically integrated producer of Optically Clear Adhesive films for mobile devices, Mitsubishi Chemical Corporation is developing new adhesive raw materials and film process techniques to overcome the challenges of foldable displays. This paper presentation will translate foldable application requirements into engineering performance targets, illustrated with examples of MCC Clearfit™ OCA films developed specifically for foldable displays.

Tolis Voutsas  
*CTO, Peratech*

Flexible display comes of age this year. It seems that the industry has finally settled on the foldable form factor as the way for the dynamically flexible display to debut in products, primarily in the mobile space. This new form factor represents a number of new challenges for the whole display stack including the touch sensor layer. The user interface, which is typically represented by the touch sensor, is now called upon to serve interactions over a dynamically changing surface, and a form factor containing new contact surfaces such as the folding edge. For an unfolded display, one-handed interaction is practically impossible, and the device interface may have to provide increased functionality at the edges of the display as well as the back. Such challenges also represent opportunities for new types of interfaces that transcend the conventional capacitive touch. Force-touch is one of these new interfaces that seems particularly suited to a dynamically flexible display. In this talk, we will discuss the advantages of flexible force touch sensing as it applies to flexible/foldable displays. We will present our technology behind the realization of ultra-thin flexible force sensor arrays that can be integrated behind a foldable OLED, or at the edges of a flexible OLED display. We will also discuss other opportunities for deeper integration of force sensors into the display module.
Since China based company Royole introduced the world’s first foldable smartphone with flexible OLED panel, Samsung and Huawei have also showcased their foldable smartphones and more mobile phone manufacturers are preparing their own foldable smart phones. However, market share of foldable smartphone expected to remain small until 2019 but can be seen rapid growth by 2021.

In this session, recent progress of foldable smart phones and vivid response for CPI will be introduced with various customer’s requirements for foldable cover window.

Zymergen is a technology company unlocking the power of biology and applying it toward the development of novel materials. Using automation and machine learning, we engineer microbes to produce unique building blocks for electronics, including clear and flexible films for use in optical displays, sensors and printed circuits. This presentation will show why new materials are required to enable foldable displays, how Zymergen is addressing this opportunity and what performance has been achieved in our initial product developments.

ActiveGrid™ is the industry’s top performing flexible and solution processed transparent conducting material and is being utilized for a variety of commercial touch sensor and display applications. Unlike conventional flexible transparent conductors (TCs), ActiveGrid™ is a totally new material formed by chemically fusing metallic nanowires into a singular nanoscale grid. In this presentation, the underlying physical mechanism of ActiveGrid™ formation will be described as well as various advanced technologies related to manipulating and improving optics and flexibility. The differentiation between conventional TCs and ActiveGrid™ will be as be explained in detail. ActiveGrid™ inks and films are valued for their performance, durability, flexibility, and process-ability; they are being utilized and developed for a variety of applications ranging from touch sensors, OLEDs, and solar cells to biotechnology and wearables.

C3Nano has also developed ActiveGuard™ - a highly flexible and scratch resistance hard-coat that is being developed and integrated as plastic replacement for cover-glass. The performance and attributes of ActiveGuard will also described.
Cover Glass

Dr. Mathias Mydlak  
*Global Business Development Manager, SCHOTT*

After the first presentations of foldable smartphone devices at the end of 2018, many smartphone set makers announced product launches or presented working demonstrators. There are still many open questions about form factors, the type of folding direction and the acceptance of the pricing strategies remain to be answered by consumers in the coming months. In parallel, technical development is very active on various design approaches for the foldable cover window structure and the materials used therein.

SCHOTT’s proprietary down draw technology allows mass production of ultra-thin glasses without secondary slimming, and is used for various glass types in our portfolio. The technology yields glass very smooth surfaces, with a mean roughness in the range of < 1 nm. Our extensive background in optical glass design, coupled with a production technology, which has been optimized for ultra thin glass for several decades, is a great starting point for foldable cover window development.

**4:05 - 4:30**

Break

**4:30 - 4:45**

Equipment for Foldables

**Yield Management Strategies for Foldable**

Peter D. Nunan  
*General Manager Display Yield Technology Group, Applied Materials*

**Applying Inline eBeam Tools to Accelerate Yield Learning**

A look back at how the semiconductor industry introduced eBeam technology to enable Moore’s law and how AKT is applying semiconductor SEM yield techniques to accelerate display yield learning.

In this presentation the author will share examples and methods by which full substrate display SEMs are being applied to accelerate the yield learning rate of the display industry and thereby greatly lower manufacturing costs.
Recent development in electronic display technologies allow us to have foldable cellphones like Samsung, Royole and Huawei introduced. Foldable displays that realize foldable cellphones have a quite unique characteristic, flexibility, during those displays under operating. That unique characteristics requires new evaluation methods of electronic displays under mechanical stresses. In order to evaluate that characteristic, IEC, International Electrotechnical Commission, TC, Technical Committee, 110, Electronic Displays developed and are developing International Standards for evaluating those flexible display. Through our talk, we are going to explore those standards for foldable displays.

In addition to that, we would like to introduce our, Yuasa System’s, mechanical endurance testing equipmentsuitable for foldable displays.

At last, for further development of foldable displays in display industry, we, Yuasa System, recently develop very unique evaluation method called ‘Visualization of mechanical stress of foldable display’ using very unique material. By using this newly developed technologies, we could see where actual mechanical stress occurs during folding motion.
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- OLED Shipments and Revenues
- Advanced TV & Smart Phone Display Costs
- Foldable Display Tech & Markets
- 8K Outlook
- LCD and OLED Fab Utilization
- Display Glass Market

UPCOMING EVENTS
IMID/DSCC Display Industry Forum
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