About IDTechEx – snapshot view

IDTechEx provides Emerging Technology insight, intelligence and networking, helping clients with their critical strategic business decisions.

Global and timely analysis through:

- Subscriptions
- Research Reports
- Custom Consulting Projects
- Global Events
- Free Web Journals

Since 1999 we have served clients in 80 countries from our bases in the US, UK, Germany, Korea and Japan
Recent investments / acquisitions

- LG announce significant investment in OLEDs on Plastic (potentially $8.71 billion)
- BOE announce potential $6.8 billion in flexible AMOLED fab
- Heliatek has secured €80m in additional funding for OPV manufacturing in Dresden
- PragmatIC has raised ~€20m from investors including Avery Dennison
- Thinfilm invests in new production site in Silicon Valley (formerly owned by Qualcomm)
- Cambrios back in business after acquisition by TPK
- Sharp (Foxconn) will invest $570m in pilot line for OLED displays
Rise of Flexible and Plastic Displays

Differentiating and creating new markets

**Thinner, lighter, more robust**
OLEDs, Quantum Dots, Flexible LCDs, E-Paper, microLEDs

**Quantum Dots help LCDs**
$500 million in 2016 for QDOT LCD to over $3 Billion in 2020

**New Battlegrounds:** Flexible LCDs, MicroLEDs

**AMOLED mobile display shipment by technology type**

$33.6 Billion in 2026

Source: Samsung
Source: FlexEnable
Source: Nth Degree
Inkjet printing used in mass production of OLED Displays

- For mass production of flexible OLED, it is essential to minimize the time and cost of depositing the encapsulation layers.

- Inkjet allows fast deposition of the organic materials without the need for further patterning.

- Nitrogen gas used to prevent material turbulence when printing.

- Inkjet printing could also be used to manufacture OLED TVs in the future.

Source: Kateeva
B/W E-reader sales have stabilised at around 5 million units a year

Growth in Electronic Shelf Labels (ESLs), signage and decorative displays

Amazon continue investing in electro-wetting technology, no products yet. Others join e.g. etulipa

KENT Displays sell millions of reflective LCDs

New start-ups enter: Clearink, Folium Optics, Etulipa, Bodle Technologies
Printed and Flexible Sensors

- Glucose sensors: revenues shrink
- Other printed sensors: include wearable and environmental sensors
- Capacitive touch on flex enabled by TCF (eg: AgNW, metal mesh)
- Hybrid CMOS image sensors starting to appear on the market. Quantum dot based.
- Sensors on TFT: mostly imagers for X-ray detectors (superior to existing detectors on the market)

Source: ISORG

Source: StretchSense

Source: MEC and Holst Centre
Conductive inks: fresh growth

- Everything is changing
- Pressure in core traditional volume markets
- Strategy for developing as broad a product portfolio as possible
- Seeding and developing multiple niche, nascent markets. Nobody wants to be left behind
- New inks are also being developed (e.g., low temperature)

Structural Electronics

“Components in a Box”

Rapid customization, material & component cost reduction, light-weighting and saving space are key drivers

Structures become functional components

- Smart Skins
- Load-bearing Components

3D Surface Printing
Surface Electronics (Source: Testo)
In Mold Electronics
Load-Bearing Supercap (Source: Volvo)
Energy Harvesting skin (Source: UW Madison)
Structural Electronics: New Horizons for Conductive Inks and Manufacturing

3D Printed Electronics for customised objects and modular electronics

In Mold Electronics IME for 3D capacitive switch panels

3D antenna printing gaining traction and now competing head-on with LDS. Saving space and reducing turn-around time are key drivers.

Rapid customisation, material & component cost reduction, lightweighting and saving space are key drivers.
Stretchable Electronics

Key Innovation Areas

- Stretchable Inks
- Flex to Rigid Connections
- Sensor Structures & Materials

E-textile market grows from $150 million in 2016 to over $3 billion in 2026

Why? Get away from commodity market, of rigid wearables

- Sports & Fitness
- Health & medical
- Wellness
- Home
- Industrial & military
- Fashion
- Others

30x increase
amount invested in stretchable electronics companies between 2012 and 2015

Smart Clothing for Sports Leads The Way

Rest Devices
Flexibility and Performance: Hybrid Systems

Source: PARC and UCSD

Source: MC10

Source: MC10

Source: Bainisha

Big Opportunities

- Connecting rigid components to flexible substrates
- Connecting flexible components to flexible substrates
- Conductive adhesion between above
Distributed Electronics

Number of wirelessly connected things

**Sold in 2020**

- **2020**: 28 Billion (RFID)
- **2020**: 1.2 Billion (IP Based Sensor Nodes)
- **2020**: 2.6 Billion (Personal Electronics: Phones, Laptops, TV)

Broad applications including retail, pharma, payments

Millions of RFID tags

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Significant problems that need to be addressed

- "Shrinkage is $60 billion yearly of $3 trillion turnover." *ECR Europe*
- Stockouts at retailers cost six percent of sales.
- More information is needed on the package, and it *has to sell the product!*
- Medication non-compliance costs the US alone approximately $100 billion and 125,000 deaths yearly
Printed Logic: Concepts

Diageo and Thin Film Electronics

PragmatIC Wine
Temperature label concept

Press Here

PragmatIC
Printed Batteries for Wearables

Flexible and/or printed batteries enable wearable tech to go wearable

Large companies are now interested (Apple, LG Chem, Samsung, STMicro etc), changing the competitive landscape.

Different types of technologies, some printed, others not

Progress with TempTraq: Now in 22,000 retail slots, two new (longer lasting) versions launched. CE approval mid 2017, then EU distribution in late 2017. Also in pilots with hospitals.

Sources: Imprint Energy, Sensium Vitals, Blue Spark
Energy Harvesting: MW to mW

MAINLY ELECTRICAL ENGINEERING
Highest market value

100kW

1W

Thermoelectric
Piezoelectric
Capacitive Electret
RF

MAINLY ELECTRONICS

0.01mW

Source: Nature Energy
Source: ACS
Source: CleanSpace

Source: Hanergy
Several Government-funded centers around the World

Diverse range of equipment from R&D to commercial manufacturing

Focus on hybrid electronics – many opportunities for equipment suppliers

Large EMS companies now very active with flexible/printed electronics
Printed, Flexible and Organic Electronics Status

OLED Displays

$16 Billion

Sensors

$6.2 Billion

Conductive Ink

$1.3 Billion

2016 Total: $23.8 Bn

- More companies are moving downstream to offer complete products
- Form factor (flexibility, thinness, lightweight) and the leading drivers for premium pricing thanks to product differentiation
- Larger, more mature industry focussed on applications with strong inter-industry collaboration

Source: IDTechEx report “Printed, Organic & Flexible Electronics Forecasts, Players & Opportunities” www.IDTechEx.com/pe
Printed Electronics Europe

Bringing End Users & Suppliers Together
CONFERENCE & EXHIBITION ON PRINTED, ORGANIC & FLEXIBLE ELECTRONICS

225 presentations in 8 conference tracks
Over 3000 attendees from 60 countries
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IDTechEx Research Report

- Market data
- Market and technology appraisal by technology type
- Case studies
- 1,000 suppliers list
- Deep profiles of 40 suppliers
- 56 tables
- 113 figures

“...The comprehensive nature of the report saved us from spending a lot of money on market research. The report was indeed very helpful, and it covered most of the areas of opportunity that my team and I thought existed, and highlighted some other areas that we hadn't considered...“

Global Integrity Ltd