E-textiles: Show me the money!

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Since joining IDTechEx, James has led IDTechEx's research around markets and enabling technologies for wearable electronics. This has included producing hundreds of interview-based company profiles for companies spanning the entire value chain, and authorship of several IDTechEx reports, including Wearable Technology, Wearable Sensors, E-Textiles and Haptics.

As part of IDTechEx's consulting services, James has worked on custom projects with billion-dollar companies based in the USA, Europe, the Middle East and Asia covering various areas surrounding wearable technology, e-textiles, and related topics. This has included detailed material and component benchmarking, competitive analyses and investment partnership advisory services.

As a speaker, James has given keynote presentations on topics including wearable technology, e-textiles, sensors, haptics and other emerging technology trends at international conferences across Europe and the USA.
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E-Textiles: Where textiles meet electronics

- Wearable Technology
- Internet of Things

- e-textiles
- Smart fabrics
- Intelligent textiles
### Definition and types of e-textile system

**Three main types of system:**

| “Smart fabric” / “System on Fabric” | Fabric is the substrate | E.g. Inks or polymers laminated onto textiles  
*Example from Clothing+ / adidas* |
|-----------------------------------|-------------------------|----------------------------------------------------------------------------------|
| Fabric is the connector           |                         | E.g. Connectors between LEDs on a dress  
*Example from FRTI*               |
| Fabric/yarn is the component      |                         | E.g. Knitted sensor for woundcare  
*Example from Footfalls & Heartbeats* |
Material usage by e-textile players: 2016

Number of e-textile players that use...

- Fibres, yarns and/or textiles: 76%
- Textile & others: 21%
- Textile only: 45%
- Inks only: 8%
- Inks & others: 8%
- Others only: 4%
- Others: 28%

All three: 7%

n = 98 (2016 report)
Material usage by e-textile players: 2017

- Conductive polymers: 36%
- Conductive inks: 67%
- Ink & polymer: 11%
- Textile & ink: 20%
- Textile only: 29%
- Conductive yarn, textile, fabric, etc.: 36%
- All three: 20%

n = 118 (2017 report)
Expanding materials options: Conductive inks

- In 2015, the majority of e-textile inks came from two companies: DuPont and Nagase (EMS).
- In 2017, most major conductive paste manufacturers now offer some type of stretchable, conductive, silver-based paste, capable of use with e-textiles. The list of examples below includes Jujo Chemical, Ash Chemical, Toyobo, University of Tokyo, Henkel, Panasonic and Taiyo, as well as DuPont and Nagase, and more.

Clockwise from top left: Jujo Chemical (FineTech 2016, Japan), Ash Chemical (Finetech 2016, Japan), EMS/Nagase (IDTechEx Show! 2015, Toyobo (Japan Nanotech 2015), University of Tokyo (Japan Nanotech 2016), DuPont (IDTechEx Show! USA 2015), Henkel (IDTechEx Show! USA 2016), Panasonic (IDTechEx Show! USA 2016), Taiyo. The conference name/location indicates where the photo was taken.  

Source: All IDTechEx photos
Several prominent component types

<table>
<thead>
<tr>
<th>Materials</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textiles &amp; yarns</td>
<td>Motion &amp; pressure sensors (MEMS, optical, inductive, capacitive, resistive, etc.)</td>
</tr>
<tr>
<td>Inks</td>
<td>Others (temperature, moisture, humidity, optical, etc.)</td>
</tr>
<tr>
<td>Other conductive materials</td>
<td>Electrodes</td>
</tr>
<tr>
<td>Other electronic components and materials</td>
<td>Heating / Cooling</td>
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<td>Lighting</td>
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<td>Connectors</td>
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<td>RFID</td>
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<td>Connectivity</td>
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E-textile components

Percentage of e-textile players developing each component type

Source: IDTechEx research interviews and study of over 80 players in the space
Connectors are a significant challenge

Textile electronics need to connect to each other and conventional electronics.

A huge variety of connector options exist, yet the most common is still the humble **snap fastener**.

The options can be:
- Permanent / detachable
- Large / small
- Complex / simple
- Washable / not
- Etc.
Challenges with e-textile connectors

- Significant challenges around …

**Materials compatibility**

- Materials
- Compatibility

**Performance requirements**

- Design features
- Performance
- Requirements

**The result**

- Standards and guidelines beginning to emerge
- Collaboration is more challenging
- Many companies hedging their bets
The market for electronic textiles: 2015

2015 total market size: $91.3m

- **Sports & Fitness**
- **Health & medical**
- **Fashion**
- **Connected apparel**
- **Others**

**PRODUCT EXAMPLES**

- **Smart clothing**
  - Fashion apparel
  - Sports tracking
- **Smart beds**
  - Advanced woundcare
- **Connected apparel**
  - Textile lighting
  - Protective clothing
The momentum has been towards sportswear

**E-textile sportswear products and demonstrators from the last two years.**

*Sources (clockwise, from top left):* Adidas/Clothing+, Myontec, Sensoria, AiQ Smart Clothing, Athos, OMSignal/Polo Ralph Lauren, Hexoskin
All eyes on the leading sports apparel brands

All major sportswear apparel brands have investigated e-textiles using different strategies.

Image sources: Under Armour promotional video, IDTechEx photos, press content, etc.
Medical applications of e-textiles

Applications include pressure mapping (e.g. pressure ulcer prevention), biometric monitoring (cardiac, respiratory, and many other metrics), rehabilitation, clinical trial monitoring, woundcare, anti-microbials (non-electronic), and many more.
Companies are making millions of dollars from e-textiles today.

However, product revenue is often less reliable than “consulting” or research grants and funding as a means of reliable cash flow. Therefore, the market today is fragmented and quite small.

We only expect this to change with a more mature value chain. We believe that large orders from sportswear brands are most likely to cause the first large step-change.

For more details, please see idtechex.com/textiles.
Issues in the early value chain

(Rough overview only)

- Value chain is complex
- Many overheads are still necessary

**Main winner = the courier!?**
Value chain example: sportswear

Historically, scaled e-textiles operations would have significant value chain challenges.

As the industry matures, many of these steps will be absorbed by a decreasing number of specialised players.

As this happens, overheads are reduced allowing companies to get closer to sustainable profitability.
Conclusions

- The market is in its infancy and is shifting very quickly.
- Lack of maturity in the value chain is preventing significant scale up in sales volumes.
- Large players are building the capability to serve large e-textile markets.
- Sports is the largest volume opportunity with the most interest.
- Medical, military and home are slower growth but with excellent long term potential.
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