# E-textiles the Need to Breath: A Novel Manufacturing Process and Textile for Lightweight Transparent Sustainable E-textiles and Wearables

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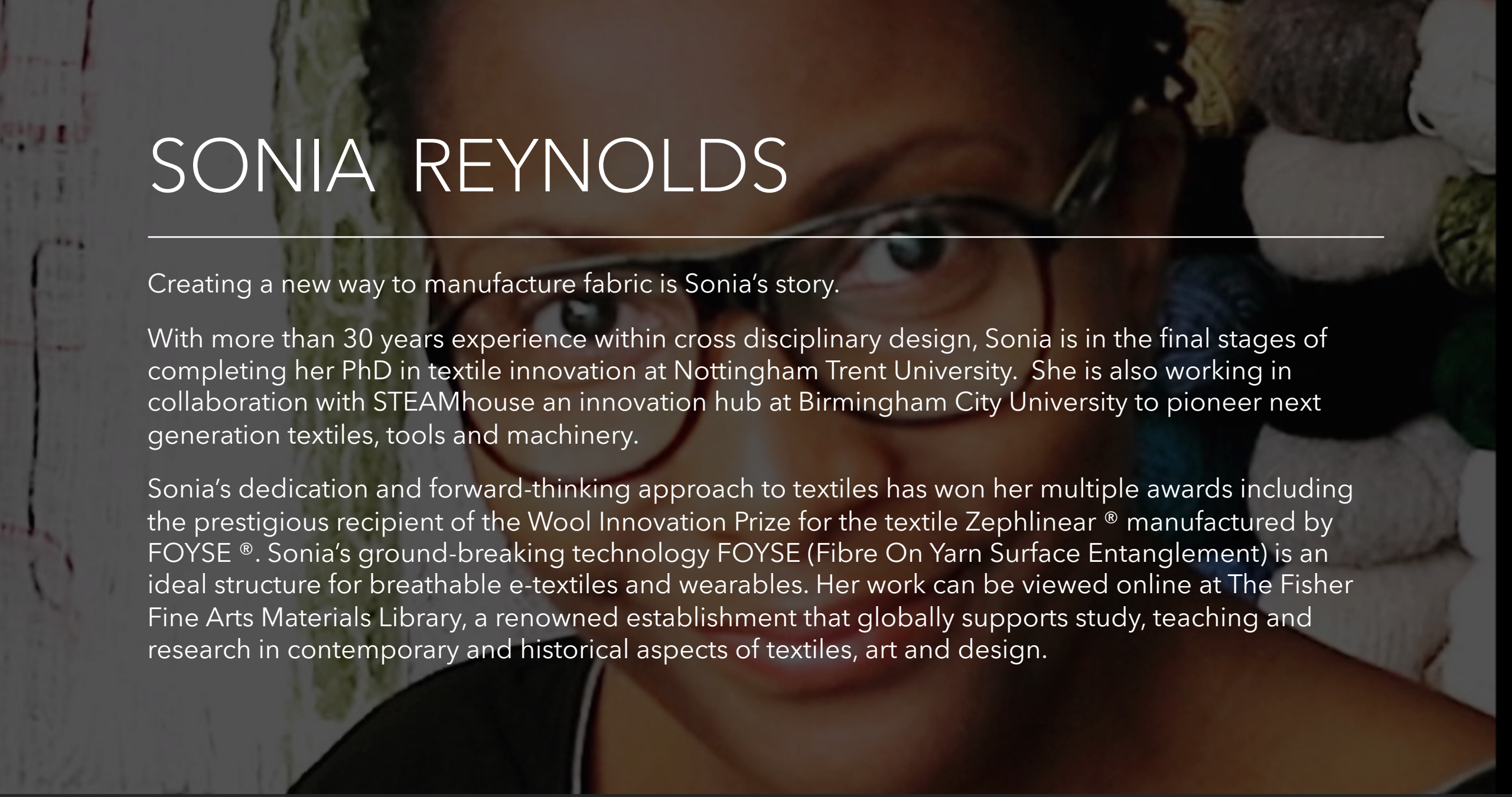

# SONIA REYNOLDS

Creating a new way to manufacture fabric is Sonia's story.

With more than 30 years experience within cross disciplinary design, Sonia is in the final stages of completing her PhD in textile innovation at Nottingham Trent University. She is also working in collaboration with STEAMhouse an innovation hub at Birmingham City University to pioneer next generation textiles, tools and machinery.

Sonia's dedication and forward-thinking approach to textiles has won her multiple awards including the prestigious recipient of the Wool Innovation Prize for the textile Zephlinear ® manufactured by FOYSE ®. Sonia's ground-breaking technology FOYSE (Fibre On Yarn Surface Entanglement) is an ideal structure for breathable e-textiles and wearables. Her work can be viewed online at The Fisher Fine Arts Materials Library, a renowned establishment that globally supports study, teaching and research in contemporary and historical aspects of textiles, art and design.

# MOTIVATION

The hypothesis:

If fibre on the surface of yarn is entangled, then a new class of textile will be created.

E-textiles and Wearables are currently made from three ancient manufacturing practices:

- The woven process that involves the interlacing of at least two yarns.
- The knitting process that involves the interlooping of a single yarn.
- The nonwoven process that creates fabric from fibre webs which have not been spun into yarn.

# Illustration of ancient Egyptian weavers dating 3600 BCE

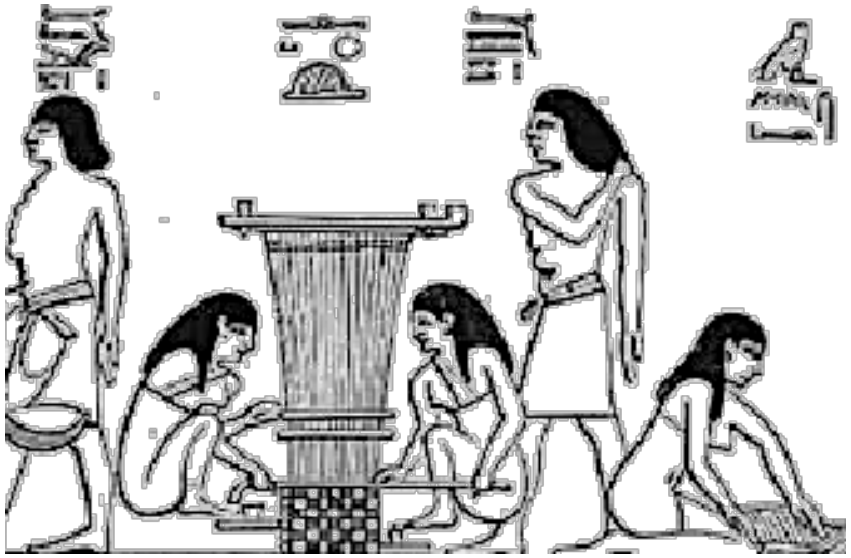

Figure 1:  Ancient Egyptian Tomb Painting of Weaving. Source: California Academy of Sciences

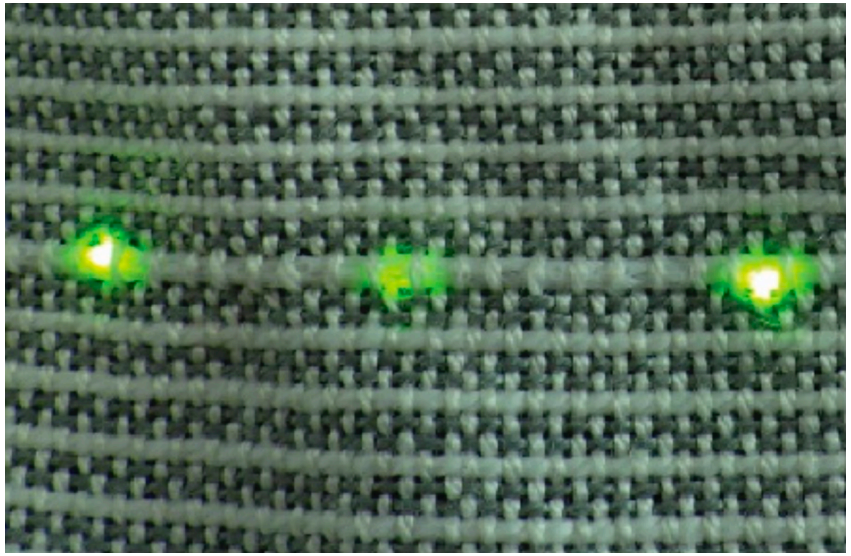

Figure 2: An example of functional yarns (LED yarns) within a woven structure. Source: Nottingham Trent University, Advanced Textiles Research Group

Historic Knitted Egyptian Socks. The earliest known examples of knitting found in Egypt and dates between 11th and 14th centuries CE.

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Machine-knitted washable sensor array textile for precise epidermal physiological signal monitoring.

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A triboelectric all-textile sensor array (TATSA) with high sensitivity for epidermal subtle pressure capturing, knitted with conductive and nylon yarns in a full cardigan stitch. Source: American Association for the Advancement of Science. Research Article 2000.

Figure 1: Cotton socks found in Egypt. From Left to Right: Textile Museum, ca. 1100 – 1200 AD; Victoria and Albert Museum, ca. 1100 – 1300 CE; Textile Museum, ca. 1300 CE.

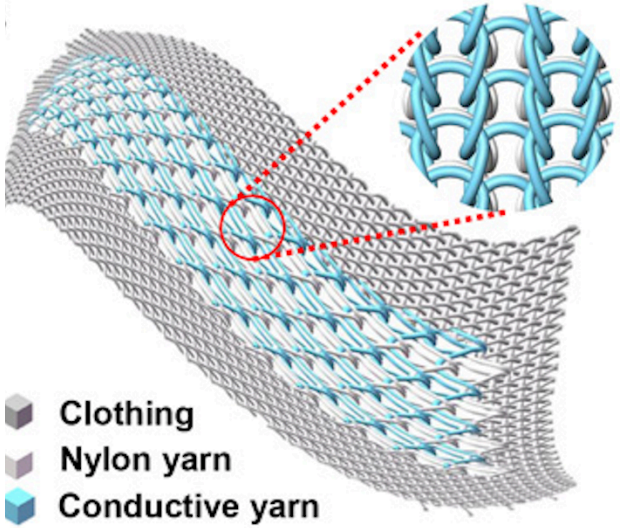



Figure 2: Enlarged view of a knitted sensor.

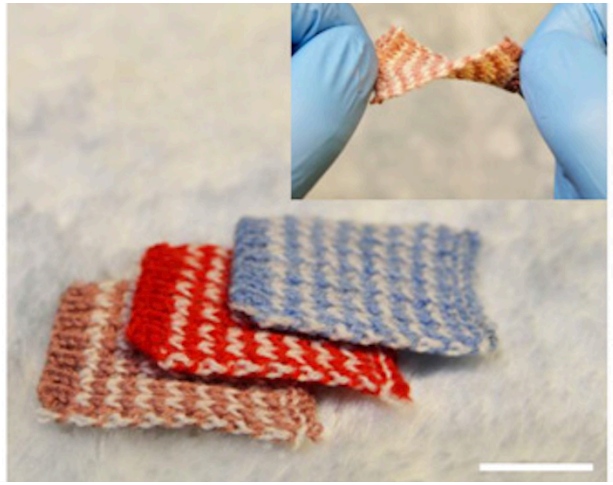
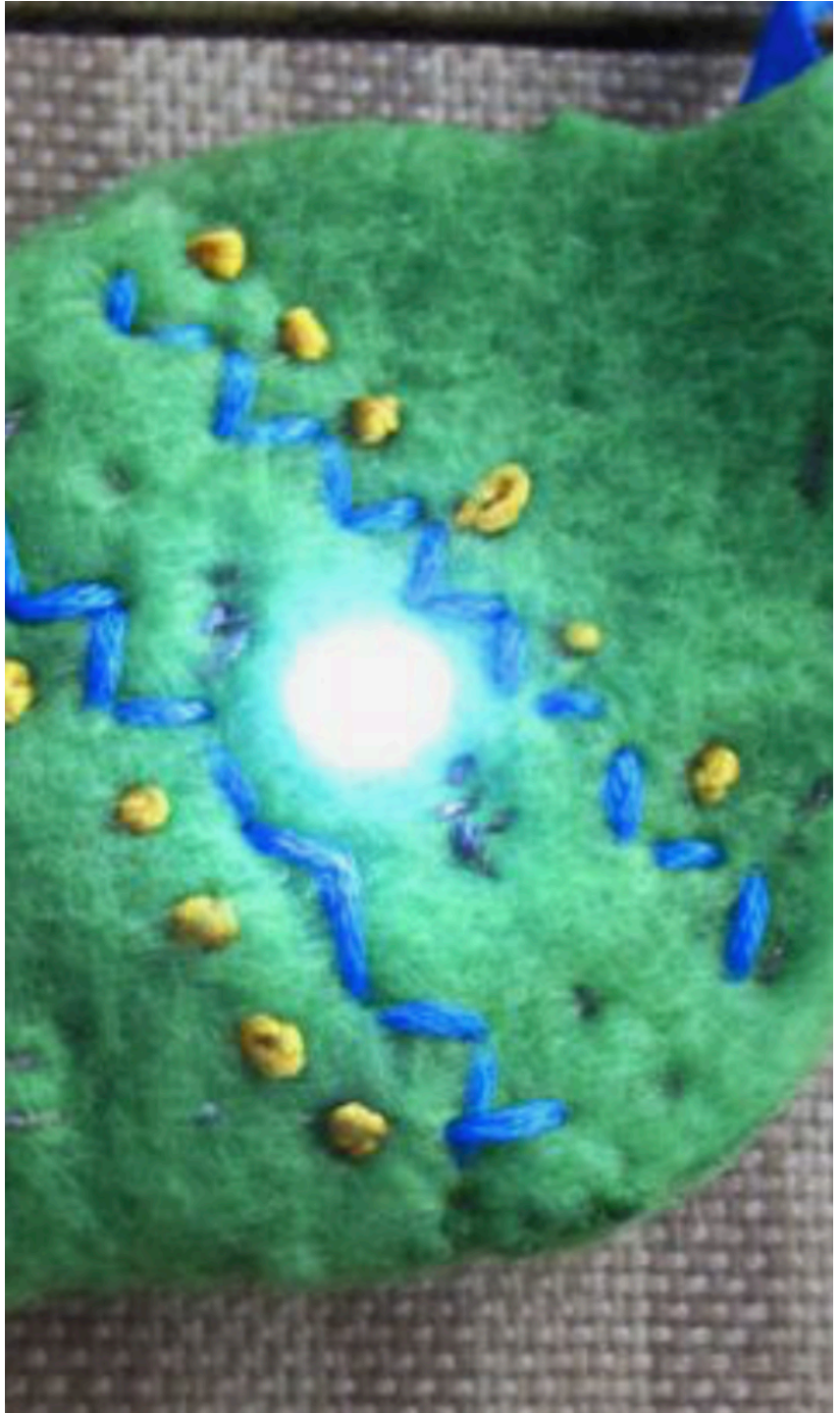


Figure 3: Photograph of TATSAs in different colours (scale bar, 2 cm). The inset is the twisted TATSA, which demonstrates its excellent softness.



Fragment of nonwoven fabric. An applique decoration for carpet or wall hanging.

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Figure 1: Felt fragments dated 252 – 238 BCE excavated in the 1920s from the graves in the Pazyryk region. Source: Washington State Heritage Museum

Figure 2:Plushie LED Ornament. Source: instructables.com

# **Introducing a new technology and textile:** A process that involves creating a fabric by fibre on yarn surface entanglement , FOYSE ®

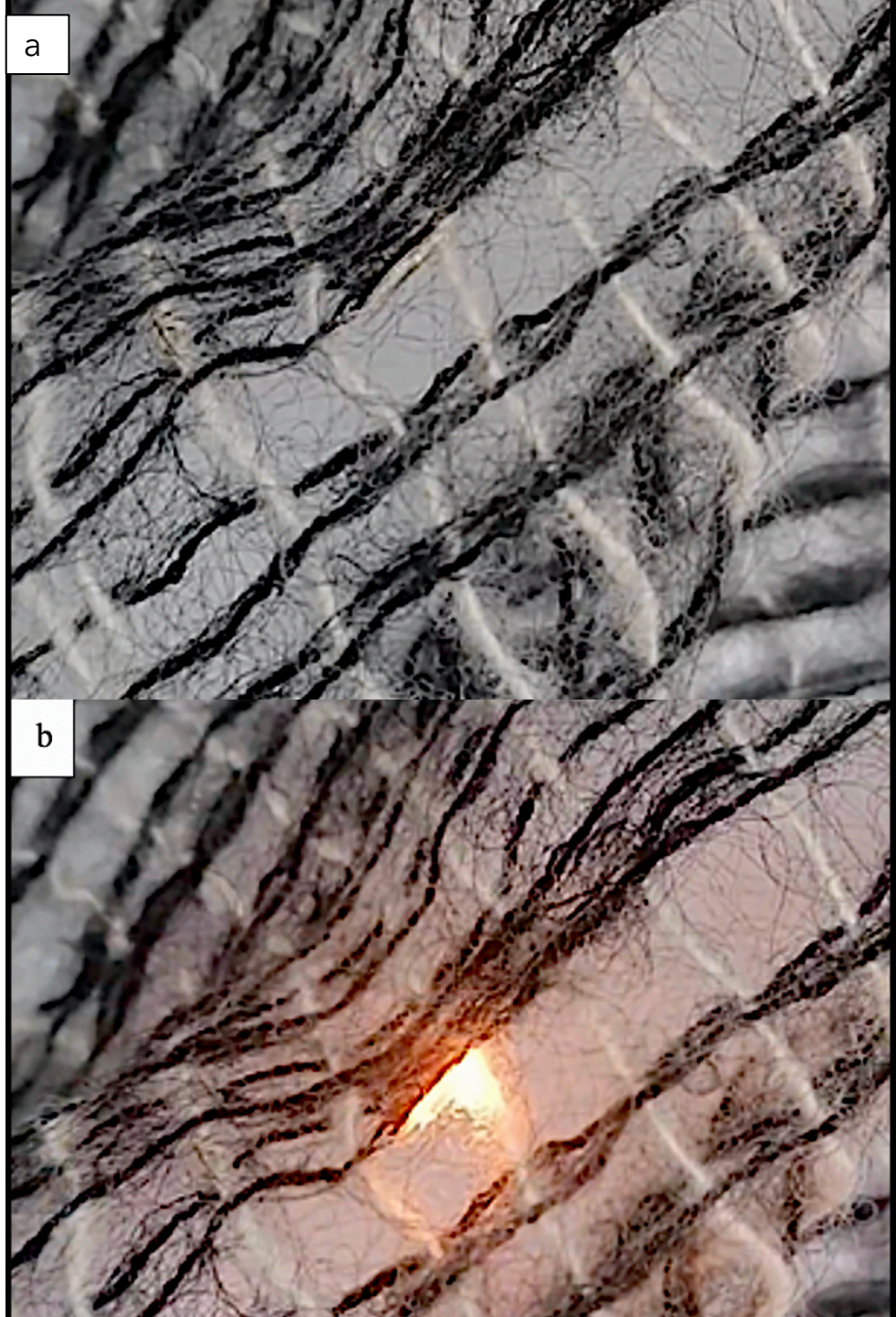
IDEAL FOR SEAMLESS
EMBEDDING OF ELECTRONICS

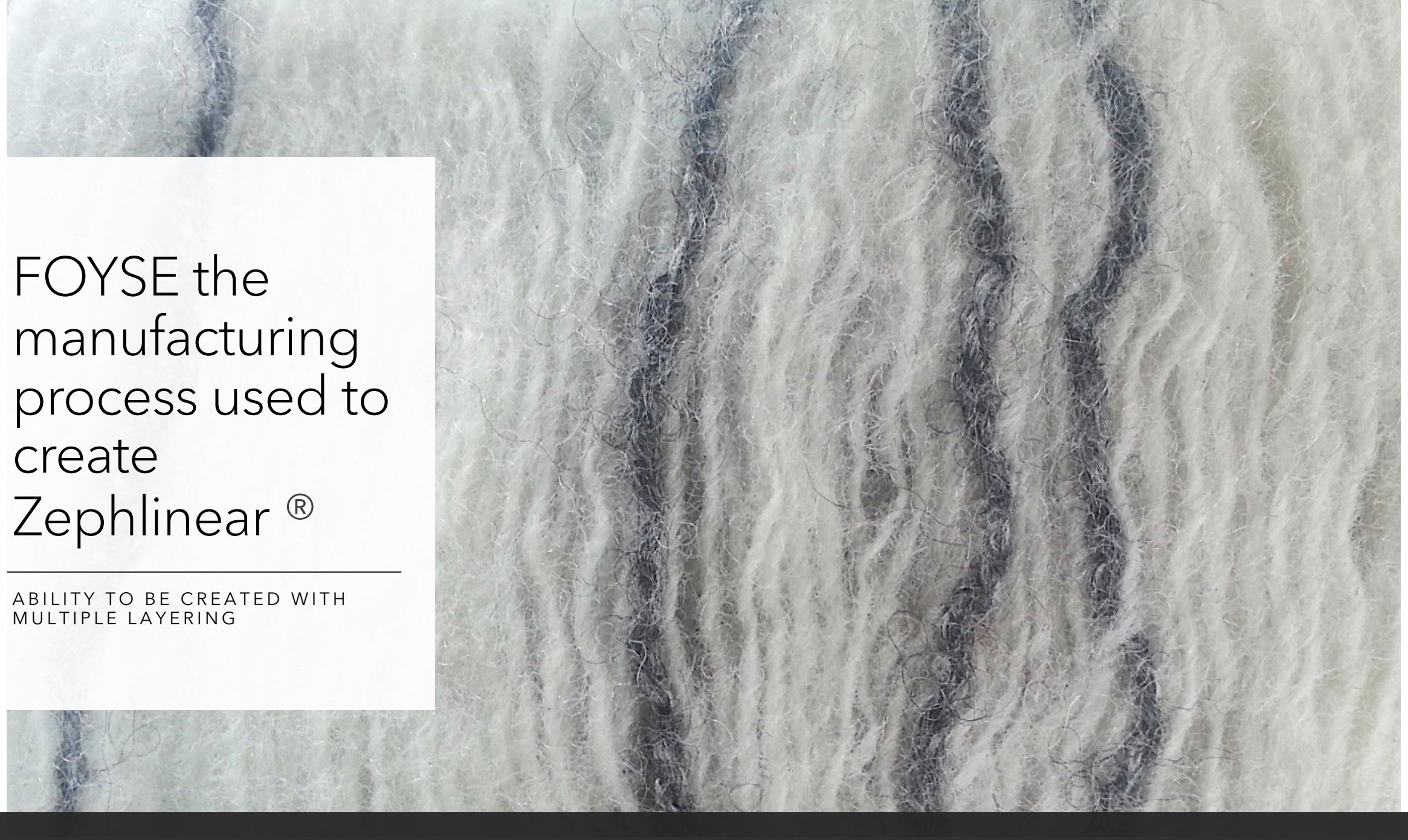
# MICROSCOPIC VIEW OF FIBRE ON YARN SURFACE ENTANGLEMENT

MICROSCOPIC IMAGE OF ENTANGLED FIBRE ON YARN

# FOYSE the manufacturing process used to create Hover-Tex

ABILITY TO EMBED SMALL COMPONANTS





# FOYSE the manufacturing process used to create Zephlinear ®

ABILITY TO BE CREATED WITH MULTIPLE LAYERING

# Future Work

Investigate machinery for full automation of FOYSE
Investigate new methods of textile manufacturing

# Thank you! Questions?

MICROSCOPIC IMAGE OF COPPER WIRE EMBEDDED WITHIN ZEPHLINEAR

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