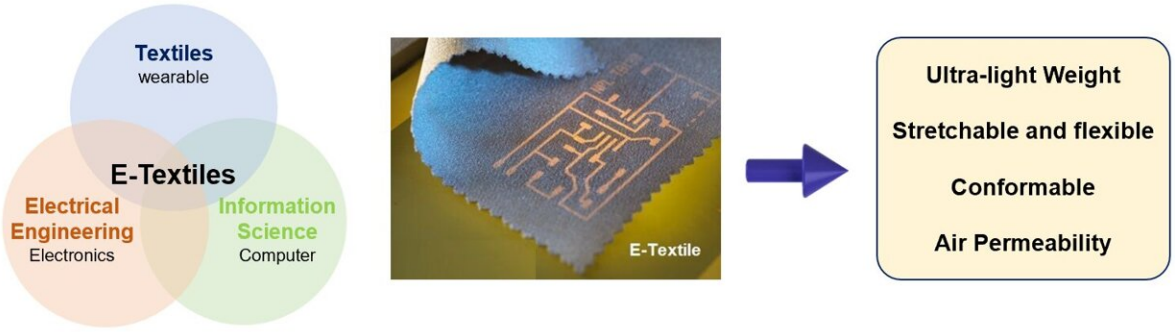
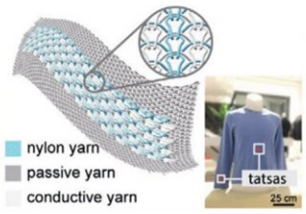
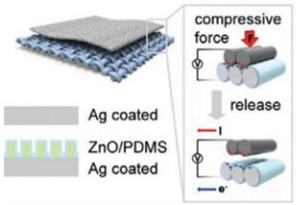
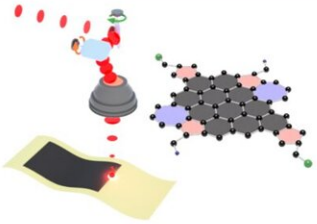
Multimodal graphene-based e-textiles for the realization of customized e-textiles developed for the first time

October 26 2023



	Conductive Fiber Weaving	Printing	LIG Patterning
Scheme			
Design Flexibility	Mid	Mid	High
Process Complexity	High	Mid	Low

(Above) Introduction on e-textiles and (below) comparison of methods for manufacturing e-textiles. Credit: Korea Institute of Machinery and Materials (KIMM)

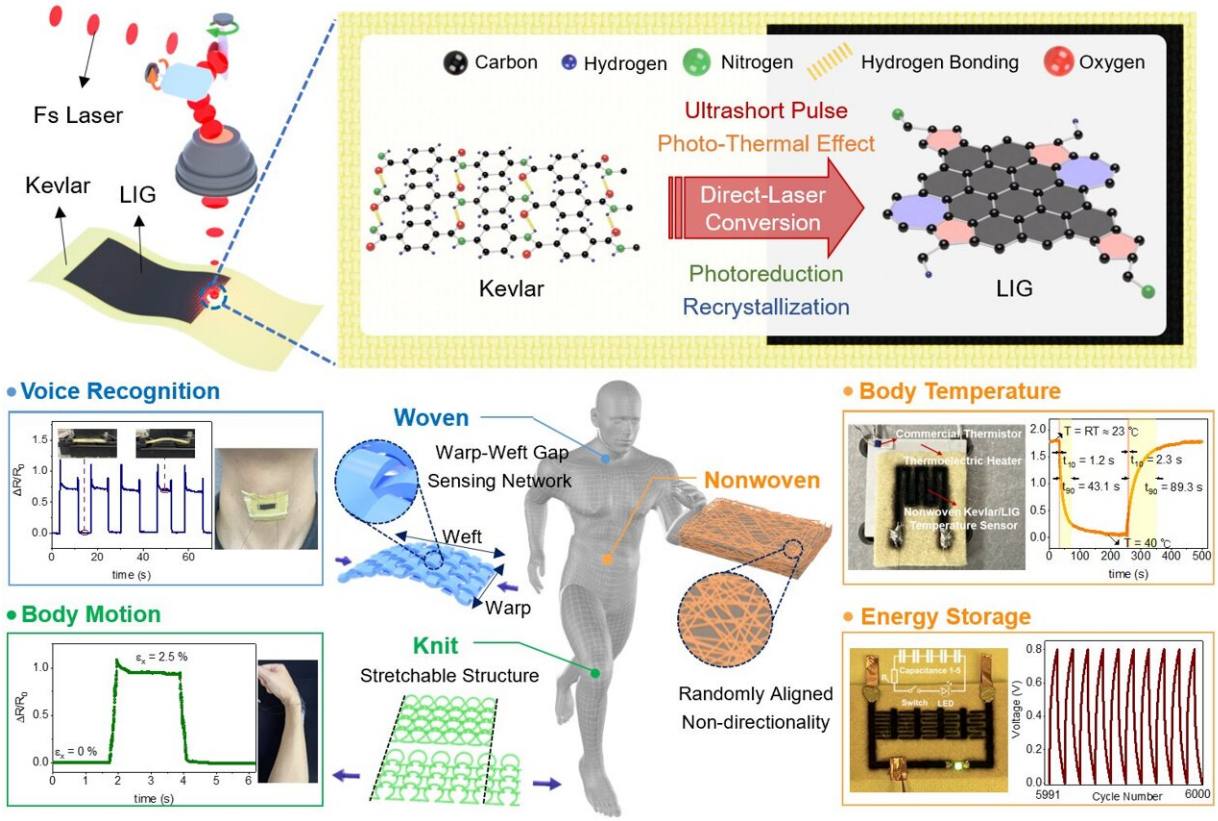
A joint research team led by Principal Researcher Soongeun Kwon and Professor Young-Jin Kim has developed graphene-based, customized e-textiles, for the first time in the world. They published their findings in *ACS Nano* in a paper titled, "Multimodal E-Textile Enabled by One-Step Maskless Patterning of Femtosecond-Laser-Induced Graphene on Nonwoven, Knit, and Woven Textiles."

Instead of using toxic chemicals or optical masks for patterning, the joint research team used laser direct patterning technology to form laser-induced graphene (LIG) on e-textiles and successfully manufactured graphene-based e-textiles.

Conventionally, e-textiles have been manufactured by coating fabrics with conductive ink to make electrically conductive textiles and then weaving them with generic fabrics, or by attaching a thin, functional layer onto generic fabrics. These methods have a low design flexibility and high process complexity. Moreover, harmful chemicals may be leaked during the manufacturing process, which places a limitation on mass production.

By using the newly developed technology, high-quality LIG materials that have world-class electrical conductivity can be manufactured simply by irradiating laser onto the surface of fabrics.

A major advantage of this technology is that e-textiles can be manufactured in an environmentally friendly manner, as neither the use of chemicals nor any additional processing is required. Meanwhile, the world-class electrical conductivity of LIG electrodes has been realized by applying the femtosecond laser processing technology.



Formation of LIG electrodes on the textile surface and their e-textile application. Credit: Korea Institute of Machinery and Materials (KIMM)

The newly developed technology can be used in the future for manufacturing industrial and military clothes for personal health management and also for producing customized "smart" clothes in the health care sector.

Kwon said, "This technology has been developed by analyzing the structures of generic fabrics and realizing them as graphene-based materials that have advanced features of optimal e-textiles." He added, "This technology is significantly meaningful in that it allows for the mass production of customized e-textiles using an environment-friendly and

simple method."

More information: Dongwook Yang et al, Multimodal E-Textile Enabled by One-Step Maskless Patterning of Femtosecond-Laser-Induced Graphene on Nonwoven, Knit, and Woven Textiles, *ACS Nano* (2023). DOI: 10.1021/acsnano.3c04120

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