京都工芸繊維大学
KYOTO INSTITUTE OF TECHNOLOGY

"OTO Mask" that functions like a microphone digitizing voice - Enables phone calls and online meetings without noise even under noisy situations like construction sites -

Smart Textile Laboratory, led by Assoc. Prof. Yuya Ishii of Faculty of Fiber Science and Engineering of Kyoto Institute of Technology (Department of Advanced Fibro-Science, Kyoto Institute of Technology), has developed “OTO Mask” (Figure 1) using the Lab.’s developed electret[a] submicrofiber mat, comprising ultra-fine fibers with the average fiber diameter of several hundred nanometers. “OTO Mask” generates electrical signals through the wearer's voice. When “OTO Mask” is connected to a commercial headset or wireless microphone, it transmits these signals wirelessly; then, the signals are converted into text on a tablet. One of the unique features of “OTO Mask” is that it picks up only the wearer's voice almost without outside sound, allowing for phone calls without interference from external noise. It is expected to be useful for making phone calls and recording voice memos in noisy environments. Furthermore, when an audio signals, including music, is input into “OTO Mask”, it plays music functioning as a speaker.

Various mask-typed acoustic sensors that digitize the wearer's voice have been developed so far. However, most of them have significantly inferior filtering performance compared to commercial non-woven masks, as the filtering function of the sensors has been overlooked. In contrast, “OTO Mask” includes the Smart Textile Lab’s developed electret submicrofiber mat, such that its ultra-high filtering performance is expected. The ultra-high filtering performance is originate from the geometrical structure of the submicrofiber mat and the constantly electrically charged electret property, where the charged property significantly enhances filter performance due to electrostatic attraction.

Furthermore, “OTO Mask” has been developed as a disposable product to ensure hygienic use. This disposable feature is also a unique aspect compared to other mask-typed acoustic sensors. Moreover, poly(lactic acid), which can be produced from biomass and is biodegradable, is used as the raw material for both the nonwovens and of “OTO Mask” and electret submicrofiber mat, making it an environmentally friendly disposable product.

Introduction movies of “OTO Mask” are available on Smart Textile Laboratory's YouTube channel following:

Introduction Movie (English): https://youtu.be/Vdb-Qic7gaE

Introduction Movie (Japanese): https://youtu.be/qU5B3wk38PA

Smart Textile Laboratory is studying in electret ultra-fine fiber mats, which are produced in a single step of electrospinning, that spins using electrostatic forces. Electrospinning is a unique spinning method that forms ultra-fine fibers and performs electrifying simultaneously, unlike other spinning methods for ultra-fine fibers including multi-component melt-spinning or melt-blowing. We demonstrated, for the first time, that electrospun ultra-fine fiber mats comprising nonpiezoelectric polymers such as poly(styrene), which do not

show piezoelectric[b] properties in their film form, show excellent pseudo-piezoelectric properties similar to the piezoelectric properties of piezoelectric materials, contrary to conventional understanding [1,2]. Additionally, we demonstrated, for the first time, unique charging characteristics of the fiber mats, such as their ferroelectricity[c] and potential for charging at high charge density [1,3]. “OTO Mask” was developed based on these research findings.

“OTO Mask” will be exhibited at the following event:

- Hokuriku Yarn Fair 2024

Date: 13th, Nov. 2024 – 14th, Nov. 2024

Location: Ishikawa Industrial Exhibition Hall, Building 4

(193 Minami Fukurobata-machi, Kanazawa, Ishikawa, Japan, 920-0361)

Exhibitor: Center for Fiber and Textile Science, Kyoto Institute of Technology

Relating patents:

Title of the invention: Piezoelectric element　Patent No.: 7370517

Title of the invention: The method for manufacturing plastic nanofibers and optical fibers as well as plastic nanofibers　Patent No.: 6718159

References:

[1] Joint press release by Kyoto Institute of Technology and National Institute of Advanced Industrial Science and Technology, June 30, 2020, https://www.kit.ac.jp/2020/06/news20200630/

[2] Joint press release by Kyoto Institute of Technology and Japan Advanced Institute of Science and Technology, August 5, 2019, https://www.kit.ac.jp/2019/08/news190805/

[3] Press release by Kyoto Institute of Technology, August 30, 2024, https://www.kit.ac.jp/2024/08/news240830-2/

Glossary:

[a] *Electret*: A material that stores electrical charges semi-permanently.

[b] *Piezoelectricity:* In this document, the term "piezoelectricity" collectively refers to the direct piezoelectric effect and converse piezoelectric effect exhibited in piezoelectric materials such as lead zirconate titanate (PZT) and piezoelectric polymers.

[c] *Ferroelectricity:* The property of a material in which electric dipoles become polarized and surface polarization charges appear without application of an electric field, and the direction of this polarization can be reversed by an electric field.

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Reference Material:

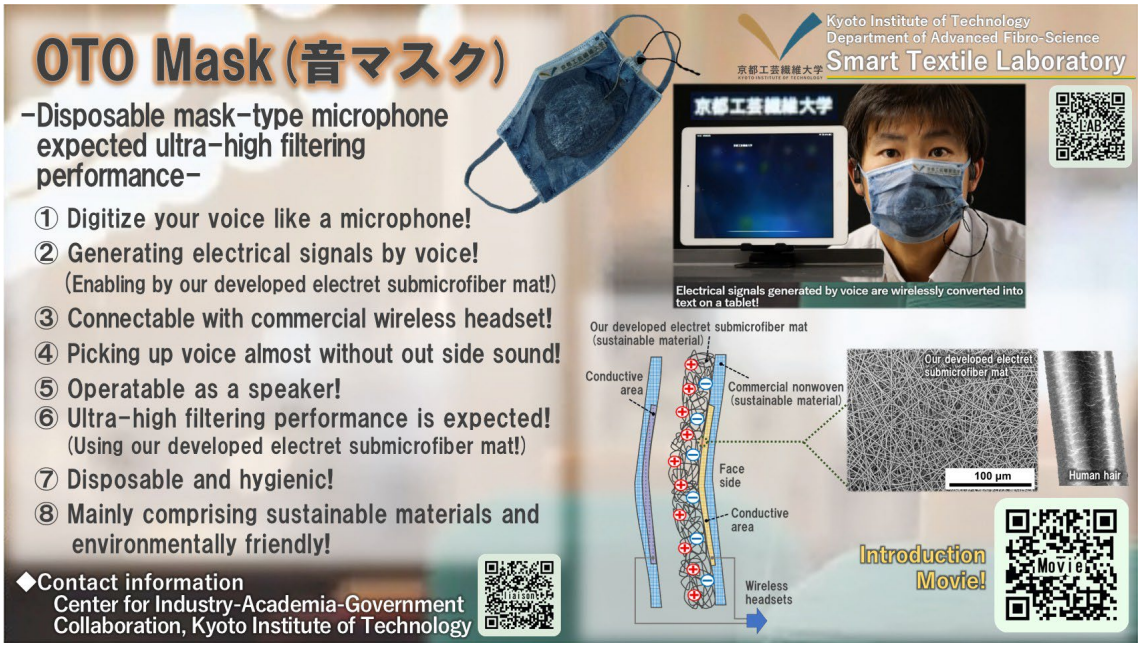

Figure 1. Overview diagram of "OTO Mask"