

# Research Highlights

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'Liquid Electret' Could Offer New Power Source for Wearable Electronics

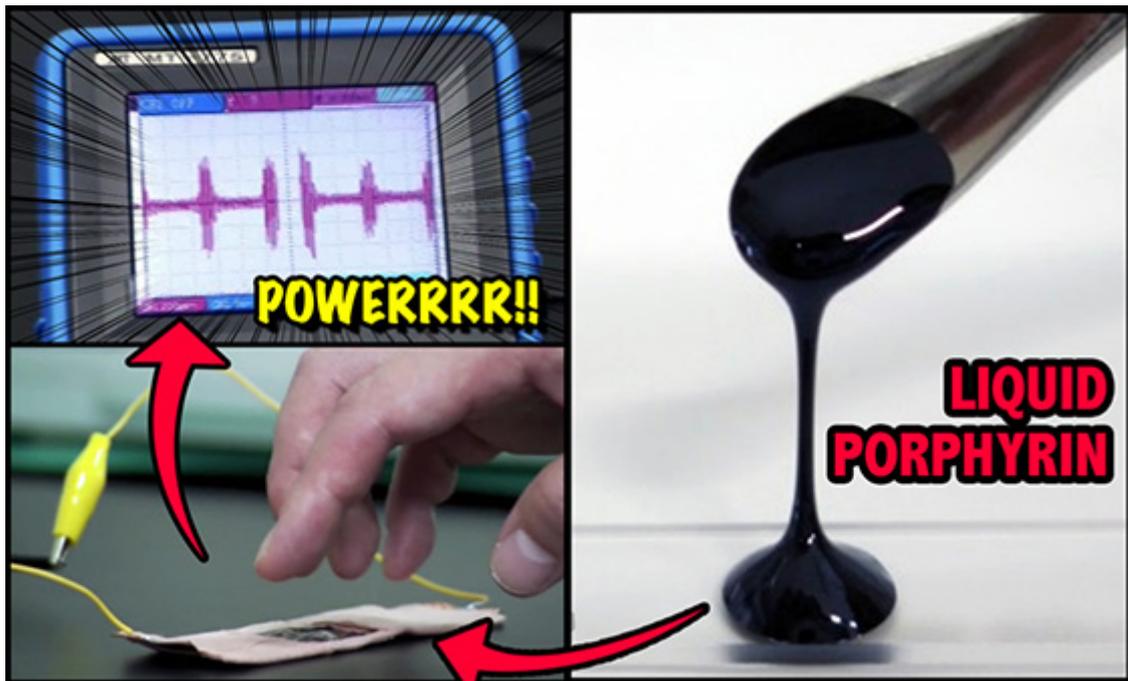
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Researchers at MANA have created a material that could power a new generation of wearable electronic mobile devices.



The finding is another step toward realizing what could be numerous potential applications for flexible mechano-electrical devices in self-powered wearable electronics, including healthcare sensors such as pacemakers, surgery tools, muscle-driven energy harvesters, communications devices and smart textiles.

The new "liquid electret" material has the mechano-electrical and electroacoustic functions, as well as the flexibility and stretchability, that would be crucial in a reliable and long-lasting power source for such devices.

Electrets are key components for powering mechano-electrical devices as they behave like a battery or as an electrical counterpart of a permanent magnet.

Electrets used in such devices are generally solid films composed of insulating polymeric materials. However, a liquid electret material would be a better solution -- it would be flexible and stretchable, and greatly enhance the usability of the devices they power. In addition, liquids offer fluidity with fast diffusion of molecules, easy processing, lack of defects and high deformability -- all requirements for flexible/stretchable device technologies.

The MANA researchers developed a new method of producing electrets, using a shielded  $\pi$ -unit of liquid porphyrins with trapped charge to create their liquid electret, which they fabricated to demonstrate its mechano-electrical and electroacoustic functions. They shielded the  $\pi$ -core with hydrophobic and insulating bulky-alkyl side chains, enabling the liquid porphyrins to store an electric charge.

This molecular design of the unconventional liquid electret presents a new direction toward mechano-electrical and electroacoustic applications for advanced wearable/stretchable electronics.

This research was carried out by [Takashi Nakanishi](#) (Group Leader of Frontier Molecules Group, MANA, NIMS) and his collaborators.

## Reference

"Soft chromophore featured liquid porphyrins and their utilization toward liquid electret applications"

Avijit Ghosh, Manabu Yoshida, Kouji Suemori, Hiroaki Isago, Nagao Kobayashi, Yasuhisa Mizutani, Yuki Kurashige, Izuru Kawamura, Masami Nirei, Osamu Yamamuro, Tomohisa Takaya, Koichi Iwata, Akinori Saeki, [Kazuhiko Nagura](#), [Shinsuke Ishihara](#) and [Takashi Nakanishi](#)

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(Press release on this research)

" Development of a Stretchable Vibration-Powered Device Using a Liquid Electret" (30 September 2019)

[https://www.nims.go.jp/mana/news\\_room/press/2019093001.html](https://www.nims.go.jp/mana/news_room/press/2019093001.html)

(MANA E-BULLETIN)

<https://www.nims.go.jp/mana/ebulletin/>

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