

## Same properties, lower cost—Copper-based alternative for next-generation electronics

April 2 2019



Copper nanopastes with low-temperature sintering property for printed electronics and die attachment. Credit: Kiyoshi Kanie

Japanese scientists have developed a technique to transform a copperbased substance into a material that mimics properties of precious and pricey metals such as gold and silver. The new medium, made of copper nanoparticles (very small copper-based structures) has promising applications in the production of electronic devices that would otherwise depend on expensive gold and silver counterparts. It is also suitable in



the fabrication of electronic components using printing technologies that are recognized as environmentally friendly production methods. The study was published on January 29 in *Scientific Reports*.

The development of the Internet of Things (IoT) has quickly increased the demand for thin and wearable electronic devices. For example, IoT depends on communication between devices, which requires antennas that have so far required expensive gold and silver-based metal composites.

To date, existing techniques for the preparation of copper nanoparticles have not been ideal as they resulted in impurities attaching to the material. Since these impurities could only be removed via extremely <u>high temperatures</u>, copper nanoparticles that were created at room <u>temperature</u> were impure and thus could not solidify into usable parts. Until now, this has been one of the hurdles to creating a more cost-effective alternative to gold and silver parts in electronic devices.

The joint study between researchers at Tohoku University and Mitsui Mining & Smelting Co., Ltd in Tokyo reports the successful synthesis of copper nanoparticles with the ability of solidifying at much lower temperatures while remaining pure. The team has altered the structure of the <u>copper nanoparticles</u> and rendered them more stable so that they do not degrade at low temperatures.





Copper nanopastes with low-temperature sintering property for printed electronics and die attachment. Credit: Kiyoshi Kanie

"Copper has been an attractive alternative material in the preparation of electric circuits. The most important part of using copper is altering it so that it solidifies at low temperatures. So far, that has been difficult because copper readily interacts with the moisture in the air and degrades, which turns into unstable nanoparticles. With the methods used in this study that alter the structure of the carbon and thereby making it more stable, we have successfully overcome this instability issue," adds Kiyoshi Kanie, Ph.D., associate professor at the Institute of Multidisciplinary Research for Advanced Materials of Tohoku University.

The researchers hope to expand the application of their copper-based <u>nanoparticles</u> beyond just electronics. They believe that this material will be useful in other sectors as well. "Our method effectively created



<u>copper</u> nanoparticle-based <u>materials</u> that can be utilized in various types of on-demand flexible and wearable devices that can be fabricated easily via printing processes at a very low cost," Kanie adds.

**More information:** Yoichi Kamikoriyama et al, Ambient Aqueous-Phase Synthesis of Copper Nanoparticles and Nanopastes with Low-Temperature Sintering and Ultra-High Bonding Abilities, *Scientific Reports* (2019). DOI: 10.1038/s41598-018-38422-5

Provided by Tohoku University

Citation: Same properties, lower cost—Copper-based alternative for next-generation electronics (2019, April 2) retrieved 27 April 2024 from <u>https://phys.org/news/2019-04-properties-costcopper-based-alternative-next-generation-electronics.html</u>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.