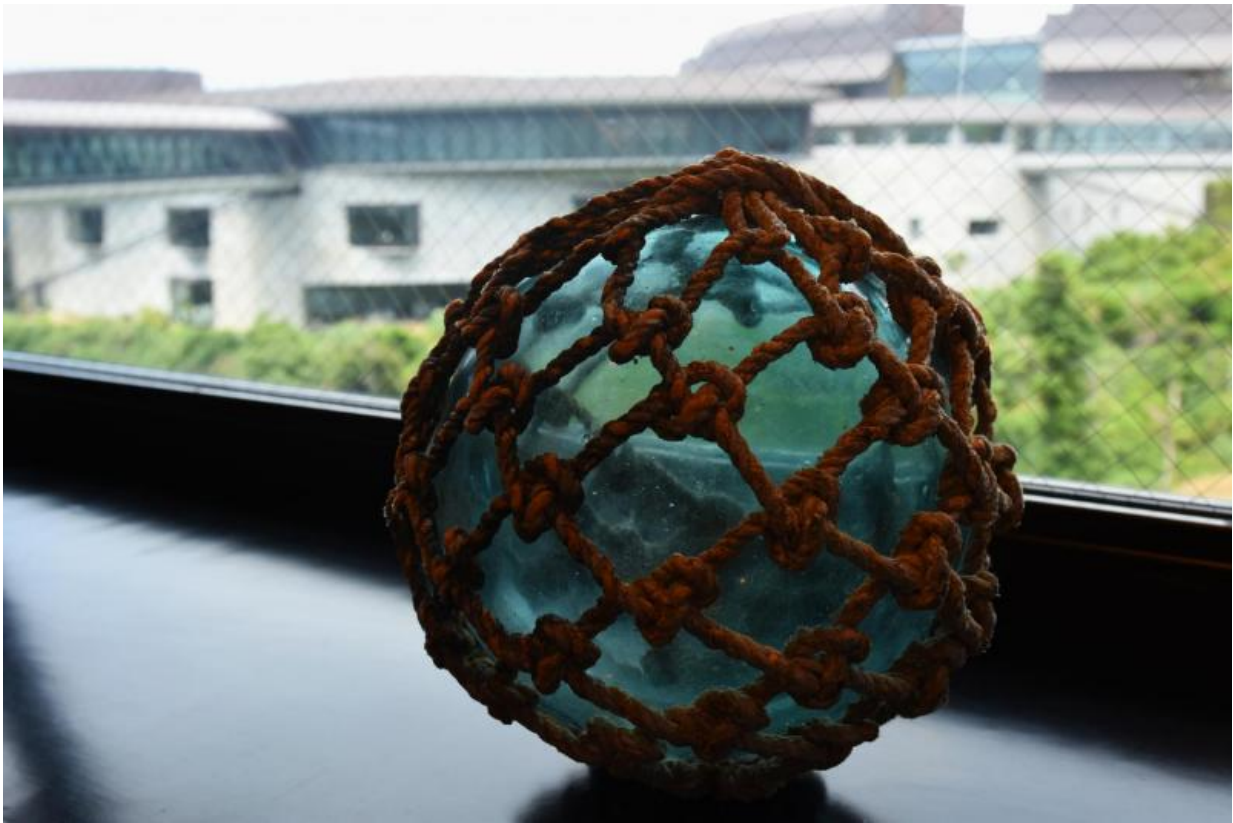


New 'uikidama' nanoparticle structure revealed

June 13 2016



Japanese glass fishing float—uikidama. Credit: OIST

Sometimes it is the tiny things in the world that can make an incredible difference. One of these things is the nanoparticle. Nanoparticles may be small, but they have a variety of important applications in areas such as,

medicine, manufacturing, and energy. A team of researchers from Okinawa Institute of Science and Technology Graduate University (OIST) recently discovered a unique copper-silver nanoparticle structure that has a core of one element surrounded by a "cage" of the other element. However, the cage does not cover certain areas of the core, which very much resembles the Japanese glass fishing floats traditionally covered with rope called ukidama.

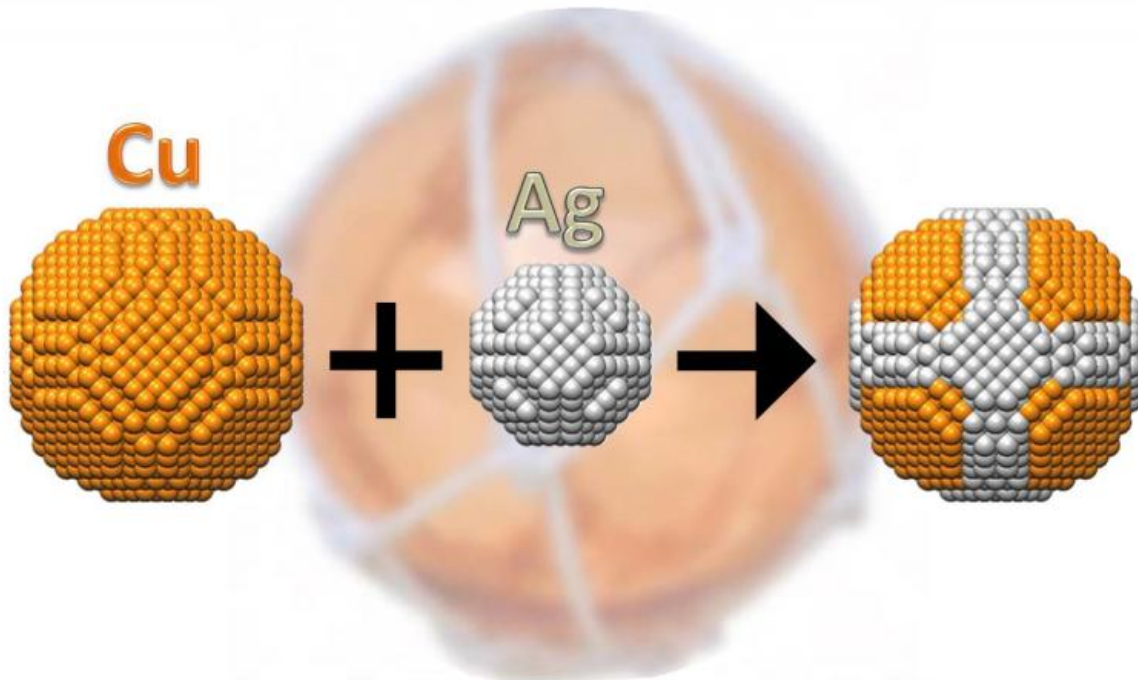
This previously undiscovered ukidama structure may have properties that can help the team on their mission for optimal nanotechnology. The results have been published in *Nanoscale*.

"The ukidama is a unique structure, which means that it can likely give us unique properties," said Panagiotis Grammatikopoulos, first author and group leader of the OIST Nanoparticles by Design Unit. "The idea is that now that we know about this structure we may be able to fine tune it to our applications."

The OIST researchers are continually working to create and design nanoparticles that can be used in biomedical technology. Specifically, the team works to design the optimal nanoparticles for technologies like smart gas sensors that can send information about what is going on inside your body to your smart phone for better diagnoses. Another application is the label free biosensor, a device that can detect chemical substances without the hindrance of fluorescent or radioactive labels. The identification of the ukidama structure is important in this endeavour because having a new structure increases the possibilities for technological advancements.

"The more parameters that we can control the more flexibility we have in our applications and devices," Prof. Mukhles Sowwan, author and head of OIST's Nanoparticles by Design Unit said. "Therefore, we need to optimize many properties of these nanoparticles: the size, chemical

composition, crystallinity, shape, and structure."



Ukidama nanoparticle schematic. Credit: OIST

The discovery of the ukidama structure was found through sputtering copper and silver atoms simultaneously, but independently, through a magnetron-sputtering system at high temperatures. When the atoms began to cool they combined into bi-metallic nanoparticles. During the sputtering process, researchers could control the ratio of silver to copper, with the rate of power with which the atoms were sputtered. They found that the ukidama structure was possible, especially when the copper was the dominant element, since silver atoms have a higher tendency to diffuse on the nanoparticle surface. From their experimental findings, the team was able to create simulations that can clearly show how the

ukidama nanoparticles form.

The team is now looking to see if this structure can be recreated in other types of nanoparticles, which could be an even bigger step in the optimization of nanoparticles for biomedical application and nanotechnology.

"We design and optimize nanoparticles for biomedical devices and nanotechnology," Sowwan said. "Because the ukidama is a new [structure](#), it may have properties that could be utilized in our applications."

Co-author, Antony Galea, formerly of the Nanoparticles by Design Unit, was responsible for the experimental portion of this study and has since moved to OIST's Technology and Licensing Section to help research – like this work being done with [nanoparticles](#) that can be utilized in applications – move into the market.

"Our aim is to take research created by OIST from the lab to the real world," Galea said. "This is a way that work done at OIST, such as by the Nanoparticles by Design Unit, can benefit society."

More information: Panagiotis Grammatikopoulos et al. Kinetic trapping through coalescence and the formation of patterned Ag–Cu nanoparticles, *Nanoscale* (2016). [DOI: 10.1039/C5NR08256K](https://doi.org/10.1039/C5NR08256K)

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