Electrocrystallization—breakthrough in gold nanoparticle research

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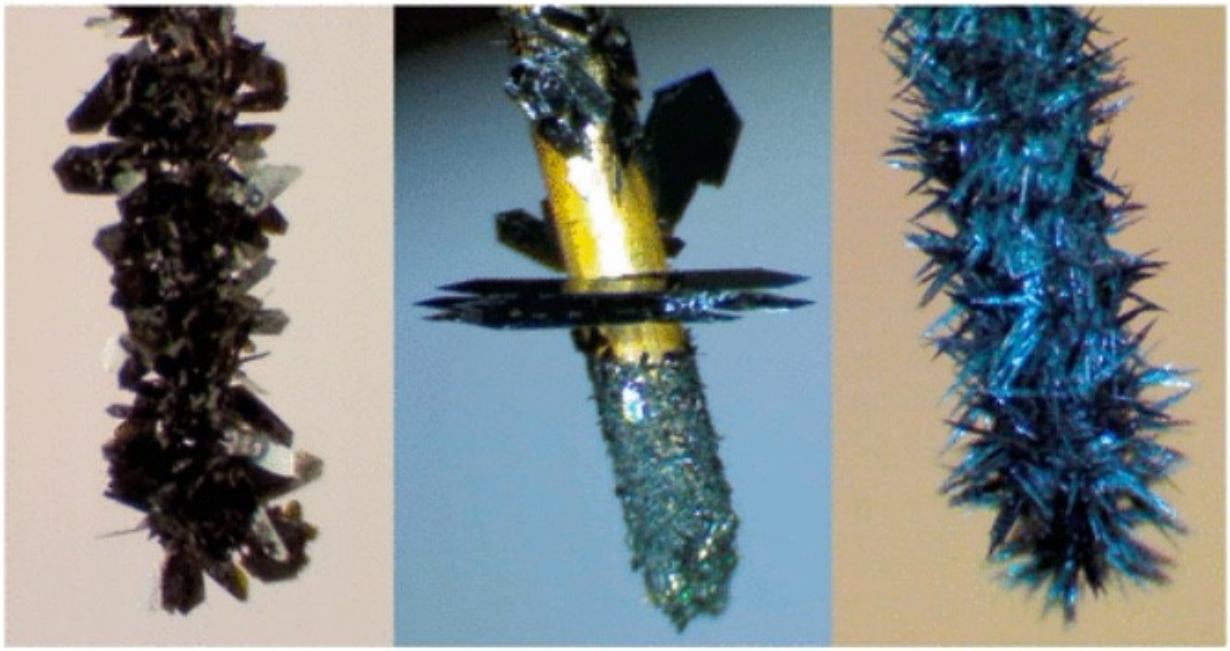

Credit: University of Jyväskylä

A research team led by Professor Flavio Maran of the University of Padova (Italy) and Academy Professor Kari Rissanen of the University of Jyväskylä (Finland) has published in the prestigious the *Journal of the American Chemical Society* a study that demonstrates how it is possible to obtain very high quality crystals formed of gold nanoparticles.

"The research on gold nanoparticles is a field of both fundamental and applied importance," explains Academy Professor Kari Rissanen of the Department of Chemistry at the University of Jyväskylä. X-ray crystallography is the most powerful method for molecular-structure determination of these nanosystems, but obtaining good quality single crystals suitable for accurate X-ray analysis has been the bottleneck in this demanding research. This problem has now been successfully addressed thanks to an electrochemical strategy called electrocrystallization.

X-ray single crystal diffraction analysis of gold nanoclusters—structures composed of a core formed of dozens gold atoms capped and protected by a layer of molecules - has the intrinsic limitation that good quality single crystals are very difficult to obtain. The team has developed an electrochemical method that allows growing high-purity crystals in large quantities and very high crystallographic quality. By allowing a very small current to flow between two electrodes, dense forests of millimeter-long single crystals can be generated directly onto the electrode surface.

"The breakthrough nature of this electrocrystallization method," continues Professor Maran," was put in practice by the single crystal X-ray crystallographic determination of the structures of four different nanoclusters each formed of 25 gold atoms. Not only these successful results validated the efficacy of the electrochemical technique, but also led to the discovery that one of these clusters crystallizes by forming needles consisting in parallel chains of interconnected gold nanoclusters, just like a multiple-strand necklace made of gold 'pearls' of only one-billion of a meter."

More information: Sabrina Antonello et al. Electrocrystallization of Monolayer-Protected Gold Clusters: Opening the Door to Quality, Quantity, and New Structures, *Journal of the American Chemical Society* (2017). DOI: 10.1021/jacs.7b00568

Provided by University of Jyväskylä