New reaction for the synthesis of nanostructures

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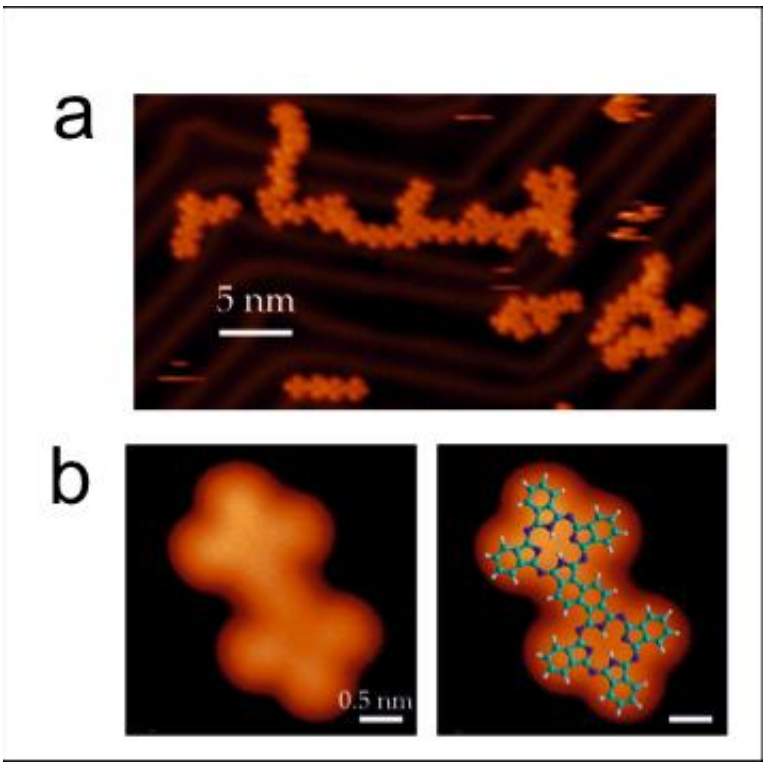

a) STM image displaying the formation of quasi-unidimensional polymers. b)STM image and models of the majority of products between coupled monomers. Credit: Dr. David Ecija, IMDEA Nanoscience

Scientists at the Institute of Chemical Research of Catalonia (ICIQ) have developed a new chemical reaction for the synthesis of low-dimensional polymers that can be rationalised as phthalocyanine derivatives. The results obtained have been published in *Nature Communications*.

Surface-mediated synthesis of low-dimensional polymers from simple molecular precursors is a rapidly emerging field. In this work, the researchers introduce surface-confined thermally tunable reaction pathways as a route to select intramolecular versus intermolecular reactions yielding either monomeric phthalocyanines or low-dimensional phthalocyanine polymers, respectively.The precursor was designed and synthesised at ICIQ's laboratories. It was then deposited on a gold surface and gently annealed to more than 300º C in order to study its behaviour.

When the temperature rises to 275º C, the polymerisation of the molecule occurs, resulting in phthalocyanine unidimensional polymers (phthalocyanine tapes) that had not been synthesised before. However, if the molecules are deposited on a substrate held at 300º C, the polymeric growth is blocked and the precursor is transformed into individual phthalocyanines. This selectivity induced by temperature, despite being a promising strategy for increasing the synthetic versatility, had not been used on surfaces up to now. Nevertheless, this technique could have huge advantages when engineering nanostructures with technological applications.

"On-surface synthesis is a promising strategy for the formation of nanostructures. This new thermally controlled reaction presents a very interesting alternative for the development of new polymeric materials that will satisfy the growing demand from disciplines such as nanotechnology, information technology and biotechnology," -say Prof. José R. Galan-Mascaros and Dr. David Ecija.

More information: Borja Cirera et al, Thermal selectivity of intermolecular versus intramolecular reactions on surfaces, *Nature Communications* (2016). DOI: 10.1038/ncomms11002