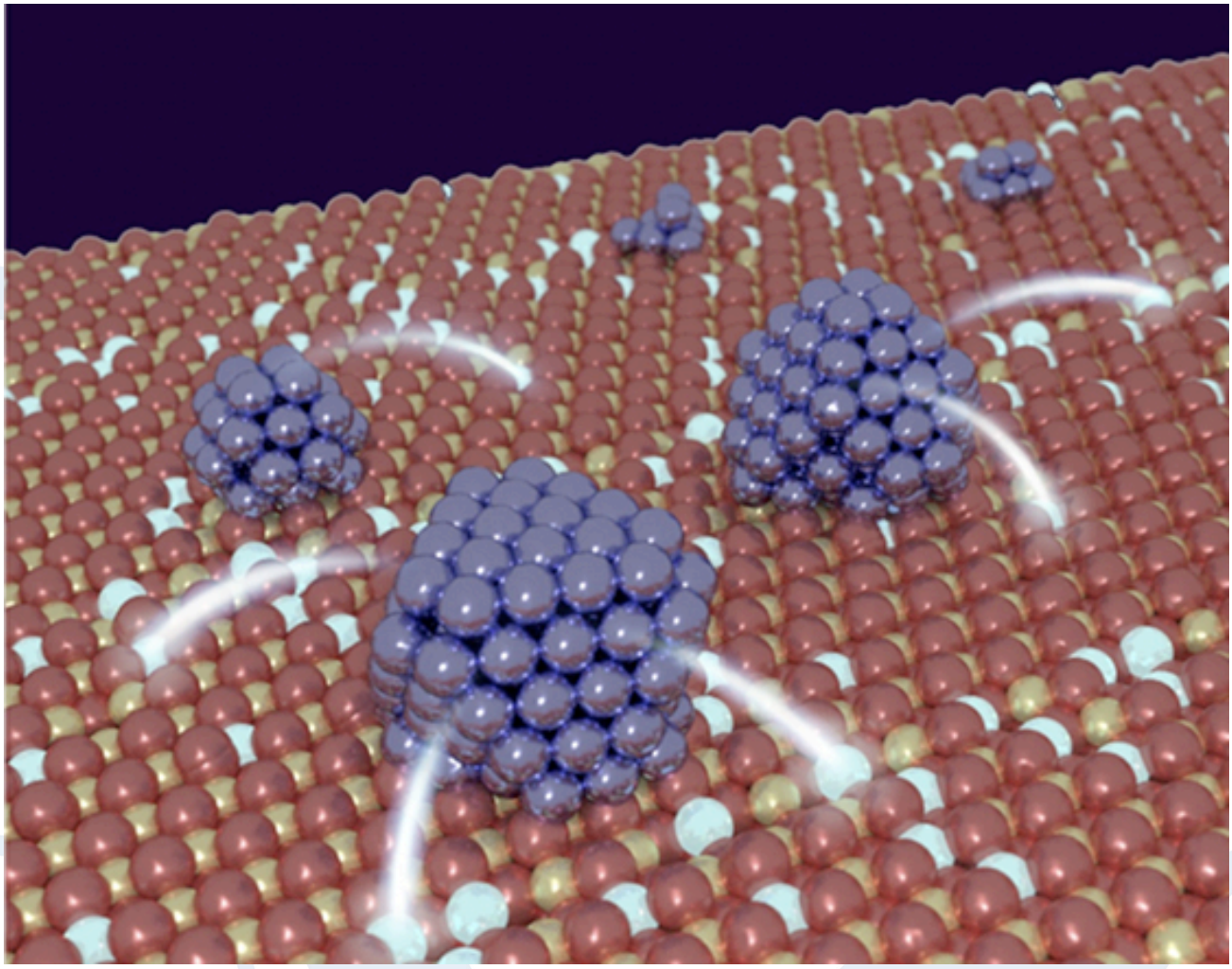
Better catalysts for green energy



More efficient nanoparticles in fuel cells: here are the guidelines

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Catalysts play a major role in the field of technology applied to renewable energy. A new study, just published in Nature Materials, provides a detailed account of how to control the electron charge of nanoparticles of platinum, an important catalyst in fuel cells, to maximize the efficiency of the process. The study is the result of an intense international collaboration involving SISSA and CNR-IOM of Trieste, the University of Barcelona, ELETTRA Sincrotrone Trieste, Friedrich-Alexander Universität Erlangen-Nürnberg in Germany and Univerzita Karlova of Prague.

What is a catalyst? A material that facilitates (increases the speed and likelihood of) a chemical reaction. In general, catalysts are rare metals (platinum, for example), which are often used in the form of nanoparticles. In the field of renewable energy, catalysts are crucial, and scientists are striving to maximize their efficiency (in part also to avoid wasting these precious materials).

Among the features that determine the catalytic efficiency of a nanoparticle is its electrical charge, which is difficult to quantify in technologically relevant systems, where the particles interact with the surfaces of other materials. For these catalysts, there is no well-defined quantification. The new study has finally filled this gap. "By combining experimental measurements and theoretical numerical simulations, we established guidelines for controlling the charge of nanoparticles and obtaining catalysts having maximum efficiency", explains Stefano Fabris (CNR-IOM/SISSA), one of the study authors. "The experimental measurements were carried out by researchers from the University of Prague at ELETTRA Sincrotrone Trieste, whereas the simulations were the result of my collaboration with the University of Barcelona".

Fuel cell for "green" methanol

The type of catalyst studied by Fabris and co-workers is important in fuel cells, that is, devices that convert chemical energy into electricity (by means of a reaction between a fuel, hydrogen or another fuel, and oxygen).
"An important line of research in the area of renewable energy is currently investigating the production of methanol using technologies that mimic photosynthesis", explains Fabris. "Should we succeed in producing methanol on an industrial scale using these technologies, then we would also need an efficient and clean way of converting it into electrical energy".

For this reason methanol fuel cells will be used, where the combination of methanol and oxygen produces water and carbon dioxide as a waste product (note that the carbon footprint in this case is neutral in that the methanol will be produced by photosynthesis, removing CO_2 from the atmosphere). "The type of catalyst we are studying is the one that will be needed in these fuel cells". The study was in fact funded by the European project ChipCAT, which aims at finding novel materials for the next generation of fuel cells.

USEFUL LINKS:

- **Original paper in Nature Materials: http://dx.doi.org/10.1038/nmat4500**
- **ChipCAT website: http://chipcat.eu**

IMAGES:

- **Credits: Sergey Kozlov and Oriol Lamiel**

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