New world record for Danish nano researchers

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Researchers at the Nano-Science Center at the University of Copenhagen have recently moved a big step closer to understanding chemical processes. Their world record comes from tracking the biggest contraction in an inorganic molecule ever.

The research group from the Centre for Molecular Movies in the Department of Chemistry have made their measurements of a molecule in solution and this implies that the results are useful for researchers, including those in the chemical industry.

"This new knowledge about how the molecules behave in solution is important because it broadens the standard for research into "wet" chemical processes. Our hope is, of course, that the results will ultimately contribute to an increased use of this method of analysis, both in the study of industrial processes and of those that take place in the human body", explains PhD Morten Christensen, who stresses that the measurements are made while the contractions are taking place.

The contractions in the molecules take place very quickly – within a billionth of a second in fact, but yet Morten Christensen and his colleagues can measure them. The measurements are made at the European Synchrotron Radiation Facility (ESRF) in Grenoble, France in a collaboration between local researchers as well as researchers from the University of Copenhagen and DTU-Riso, among others. The results have just been published in the prestigious journal Inorganic Chemistry.

"We are using the technique of time dissolved X-ray scattering, which gives a "real time" image of the electron density of a molecule both before and after the contraction. We start the reaction with an ultra short laser flash and can then, using a particularly intense type of X-ray radiation, follow how two atoms of the element Iridium draw closer together. This is our background for measuring the large contraction that the molecule displays," explains Morten Christensen, who is proud to be a record holder.

To be more precise, the two atoms move 140 picometres (140 millionths of a micrometre) closer together. That is a 62% increase over the previous record from 2004, where an American research group was able to report that two Rhodium atoms moved 86 picometres closer together in response to a light pulse.

These are very small sizes and it goes so incredibly quickly that it can be difficult to relate to.

"Very roughly, our result corresponds to getting two beach balls of metal to move more than a metre in much less than a second – using only light. Any experience shows that such a thing is not possible in "our" reality, but luckily the rules are completely different when we are acting on the same scale as atoms and molecules. And this is one of the things that make nanotechnology so exciting," ends Morten Christensen.

Provided by University of Copenhagen

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