How to count nanoparticles

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Nanoparticles of a substance can be counted and the size distribution can be determined by dispersing the nanoparticles into a gas. But some nanoparticles tend to aggregate when the surrounding conditions change. Scientists at the University of Gothenburg, Sweden, have shown that it is possible to sort and count the particles, even when they have formed aggregates.

"Nanoparticles are already used in many everyday products, such as sunscreen and cosmetics. It is important to be able to determine their size, shape and surface area, in order to be able to improve their properties within various areas of application", says Ann-Cathrin Johnsson of the Department of Chemistry at the University of Gothenburg.

A nanoparticle is a particle with a diameter that is much smaller than one millionth of a metre. Such small particles are not influenced by gravity and thus they do not fall to the bottom of a liquid or gas, and instead spread out throughout the container. Their area of contact with the surrounding medium is very large due to their small size, as a result many interesting properties arise. Nanoparticles of a substance behave, quite simply, differently than large particles of the same substance.

Certain types of nanoparticles can start to aggregate in special conditions, and sometimes a so called gel may form. The process is similar to that of boiling an egg: the proteins in the egg white aggregate and form the solid-like structure that we recognise as boiled egg.

Ann-Cathrin Johnsson's thesis work has studied one of these aggregating systems, colloidal silica. The gel that forms when salt is added to colloidal silica can be used, for example, to seal rock and to stabilise soil.

"I started with a method that had been used only for analysing nanoparticles that had not aggregated, and developed it further. Nanoparticles that have aggregated can be analysed individually if a colloidal silica gel, which contains these aggregated nanoparticles, is first diluted and then dispersed into the gas phase. If the samples are analysed immediately after being diluted, this method gives an accurate picture of the gelated system.

Provided by University of Gothenburg