Constructive Impact Experiments of Single $HAuCl_4$ Micelles

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Nanoparticle-functionalised materials are being produced and tested for applications in catalysis and sensing due to their extraordinary physicochemical properties. In the size regime of nanometres, the reactivity and optical features do not follow linear trends. Instead, small changes in the size, composition or shape of nanoparticles have a large impact on their properties that exceed those of their bulk congeners. This makes them highly attractive for application.

In order to develop an effective solution for a given industrial challenge, the understanding of particle preparation is crucial. Current ensemble studies that employ the reduction of metal salts to billions of particles — simultaneously — yield limited insight into the underlying processes. Nearly all industrially relevant particles form within a size range instead of a single chemically pure compound, which further impedes the investigation.

In order to overcome these obstacles, we look at individual events of the electrochemical reduction of $HAuCl_4$. In the so-called “impact” or “collision” experiments, micelles that are loaded with $HAuCl_4$ are reacted at an electrode — one by one — to form nanoparticles which can be subsequently used in catalytic reactions. Instead of chemical reducing agents, that lead to contamination of the product, an electrical potential is applied at the electrode and the resulting reduction charge transferred for each particle provides information of the underlying processes. In this talk, this novel concept of constructive impact experiments will be presented.