



# Atomic Engineering of Nanoparticles, From Fundamental Structure to Scale-Up and Applications

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The work of Swansea University's Nanomaterial Lab covers a broad range of industrial applications, as well as a diverse selection of nanoparticle structures. In this talk, an overview will be given of the most significant recent developments to come from the group, both in terms of fundamentals and applications.

On the fundamental side, variable temperature imaging of size-selected Au and Pt clusters (by aberration corrected TEM) probes the behaviour and dominance of particular atomic structures in relation to cluster size. In the case of Au, the familiar competition between face-centred-cubic and decahedral structures arises, validating the new method. For Pt, we establish a transition from the 5-fold Icosahedral and then Decahedral isomers to the bulk FCC structure as size increases from 150 to 450 atoms.

On the applications side, materials made in conjunction with Grove Nanomaterials (Swansea University spin-out company) are used to explore Surface-Enhanced Raman Spectroscopy (SERS), catalysis and diagnostics. Nano-platelets, which are mono-layer arrays of  $\sim 10\text{nm}$  Au NPs, are shown to be functional SERS substrates without the need for chemical-induced aggregation, as is common for colloidal substrates. These same platelets are also shown to be catalytically active for 4-Nitrophenol reduction, raising questions about the steric effects of polymer ligands. Lastly, fluorescent quantum dots are made with the same process as the aforementioned platelets, with potential uses as biomarkers or in diagnostics tools such as lateral flow tests (LFTs).

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**Host:** Sergio D'Addato