MONASH University

DEPARTMENT OF MATERIALS ENGINEERING

Seminar

TUNING THE OPTICAL PROPERTIES OF SINGLE GOLD NANOPARTICLES

Dr. Alison M. Funston
NanoScience Laboratory, Bio21 Institute and School of Chemistry
The University of Melbourne

5th November 2009, 10:00 a.m. – 11:00 a.m.
Science Lecture Theatre S1

The interaction of electromagnetic light waves with metallic conductors causes free electrons on the surface of the metal to oscillate in resonance with the light wave. These waves are known as surface plasmons. Miniaturization of the metal to form nanocrystals with dimensions less than 100 nm results in the spatial confinement of the conduction electrons within the particles and a localised surface plasmon resonance (LSPR). It is the LSPR which gives rise to the intense colours of such particles. The resonance energy is highly sensitive to the size and morphology of the particle and by tailoring the shape of the particles it becomes possible to tune the optical properties of the material across the visible and NIR spectrum. In addition to the passive control of the resonance energy via changes to the particle size or shape, more active control is possible and leads to a large number of possibilities for the use of metal nanoparticles as sensors and within optoelectronic applications. These methods include control of the nanoparticle environment, the electronic charge of the particle as well as the interparticle spacing.

In this presentation the manipulation of the energy of the LSPR of single gold nanoparticles using the above methods will be shown. These single particle investigations have been extended to allow for the detection of electron transfer reactions on single particles. Some examples include Au catalysed electron transfer processes, the growth of single gold nanorods (detected *in situ*), and the electrochemical charging of gold nanorods. The rate and number of electrons transferred (or atoms reacting) may be directly obtained from the energy shift of the plasmon resonance with time. The interaction of two or more closely spaced metal nanoparticles also leads to changes in the energy of the surface plasmon resonance. The interparticle coupling and thus plasmon energy may be controlled through the interaction geometry as well as nanoparticle separation. This will be shown for single dimers and trimers of gold nanoparticles with known geometry at very close approach. This will be discussed with reference to the limits of the recently reported “Universal Plasmon Ruler” which may be used as a distance reporter.

Visitors are most welcome: Please note the parking arrangements. There is a designated Visitors Car Park (N1) clearly ground-marked by white paint and tickets, at a cost of $3/day, are available from a dispensing machine. (‘Blue’ permit designated areas are for Monash members only.). It is also possible to park at other designated Visitors Car Parks (E1, S1 and S2) on the Clayton Campus, but tickets are $1.4/hour.

Convenor: Prof. Jian-Feng Nie
Tel: 9905 9605
Email: nie@eng.monash.edu.au