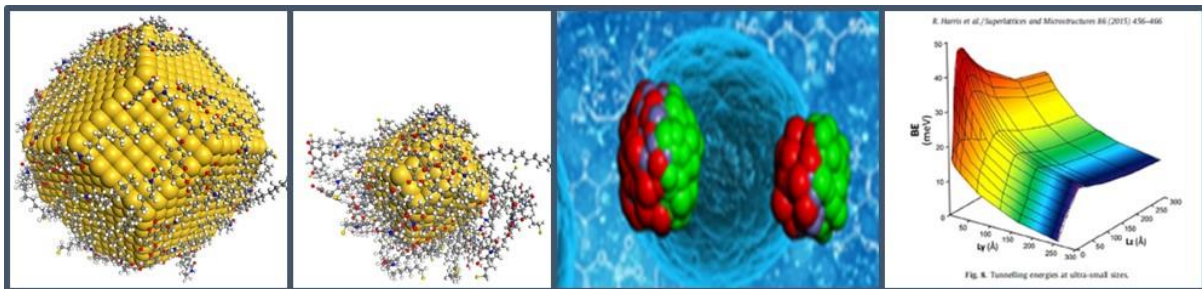


Nanotechnology



A wide variety of materials with a diameter of less than 100 nm have unique properties. Nanotechnology is being promoted as the technology that will drive the next industrial revolution. My research interest include: the engineering of novel nanosystems, experimental investigation of current systems as well as the modelling and simulation of various nanosystems (ranging from semiconductor and metallic to super-paramagnetic) for chemical- and bio- sensors, nanocatalysts as well as energy applications. Through computational modelling and simulations, novel nanoscale materials with user-defined properties may be investigated and engineered even before they are synthesised in the lab. These systems may (computationally) be probed at the atomic scale. Fundamental techniques of theory, modelling, and simulation like density functional algorithms, quantum Monte Carlo techniques, *ab initio* molecular dynamics, as well as advances in classical Monte Carlo methods may deliver novel insights into the fundamental properties and applications of nanoscale systems.



Thin Films

Conventional bulk- and thin-film diffusion has been a topic of study for many years and these studies have addressed various technical problems which are encountered whenever two dissimilar materials are joined together. One such system is the platinum-aluminium (Pt/Al) thin-film couple. It is well known that these Pt-based systems have high-temperature applications since it provides superior resistance to environmental- corrosion and oxidation. In the pursuit of increasing the efficiency of modern gas turbines, the working temperatures of various parts of the engine are increased. This increase in working temperature creates new oxidation challenges. To overcome these high-temperature oxidation problems, various surface coatings and coating techniques are being developed and studied. Through electron-beam physical vapour deposition (EB-PVD), high temperature treatments, nanoparticle implantation and Monte Carlo simulation techniques, new alloy-coatings are being developed and studied with the goal of improving material strength as well as providing improved oxidation- and corrosion resistance.

