AIBN Master Projects | Associate Professor Idriss Blakey

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Plasmonic chemical dosimeters

A/Prof Idriss Blakey

Surface Enhanced Raman Spectroscopy (SERS) has been shown to be a highly promising molecular sensing technique, especially in aqueous and biological applications due to its high sensitivity, rich spectroscopic information. Due to the nature of SERS, a plasmonic metal substrate is required to achieve Raman signal amplification and gold nanoparticle (AuNP) assemblies can provide an easy to modify, and simple to synthesise substrate that provide excellent Raman signal enhancement. Most SERS substrates directly detect chemical species when the adsorb to the gold nanoparticles. This approach is useful for simple samples but fails when applied to multicomponent samples such as biological samples. An alternative approach is to pre-label the gold nanoparticles with a molecule that has specific reactivity with an analyte of interest, which will be the focus of this project.

Surface modification of natural polymers

A/Prof Idriss Blakey, Prof Jason Stokes

Structural anisotropy in viscoelastic materials is desirable for directional-dependent responses to external stimuli (mechanical, electric field, temperature) and transport processes (diffusion, permeability, poroelasticity). It is commonly observed in nature within biological materials where it is crucial to the function of the eye (cornea, vitreous), muscles, and plant growth. However, the fabrication of viscoelastic synthetic materials (hydrogels) with complex structural anisotropy, particularly with the spatial heterogeneity required for biomimicry, has proved very difficult. This project seeks to address this by using charge directed self-assembly of block copolymers to modify the surface properties of nanocelluose, a naturally derived crystalline polymer. This change to the surface chemistry will manipulate the phase properties of these materials to formhydrogels that have applications ranging from biomaterials, to sensors and food additives.

Photothermal release of encapsulated enzymes

A/Prof Idriss Blakey, Prof Traian Chirila (Queensland Eye Institute)

Gold nanoparticles have interesting optical properties. An example of this is their remarkable ability to convert light energy into heat. In this project you will be encapsulating biomolecules such as enzymes with polymer microcapsules that are embedded with gold nanoparticles. When these microcapsules are irradiated with specific wavelengths of light, this causes the capsules to rupture and release the biomolecule payload. For enzymes this allows time and site specific release so that the biological enzymatic function can be controlled both spatially and temporally at will.

Contact the project advisor directly to discuss the project and arrange a meeting or AIBN Events (aibn.events@uq.edu.au) to arrange a visit to the AIBN lab.

Contact Information

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