

Title: Carbon Nan tubes in Metallic Surfaces

Acronym: CNTMETSURF

Submitted by:

Wouter Klopper (wouterkl@mweb.co.za)

Tel: 012 305 3139 Mobile: 083 308 0173

Postal Address: PostNet Suite 297 Private Bag X26 Sunninghill 2157

Theme: Nanosciences, nanotechnologies, materials and new production technologies

Focus Area: Nanosciences and nanotechnologies

Type of project: R&D project (small scale)

Summary: The incorporation of carbon nanotubes in metallic surfaces may impart a number of beneficial properties to such surfaces. The use of lasers as controlled sources as heat is believed to be vital in achieving successful incorporation.

Expertise offered: - Laser welding and cladding - Metallurgy - CSIR Nanotechnology Research Group - Exploratory work in the field

Previous FP involvement: Yes

Details of previous FP involvement: Currently in SSA EUDEVLAS; in process of joining STREP FANTASIA

Consortium status: None

Expertise sought: European organisations working in the proposed field/commercialisation partners

Related projects: None

Title: Bio-photonic nanodevices

Acronym: BIO-PD

Submitted by:

RAYMOND SPARROW (rsparrow@csir.co.za)

Tel: +27-12-841-3741

Postal Address: P.O. BOX 395 NATIONAL LASER CENTRE - CSIR, BUILDING 46, 2nd FLOOR, PRETORIA, 0001, SOUTH AFRICA

Theme: Nanosciences, nanotechnologies, materials and new production technologies

Focus Area: Nanosciences and nanotechnologies

Type of project: Implementation support to FP7s

Summary: To develop light activated and controlled biologically based devices, machines and systems. Using the principles of engineering applied to biological materials, processes and systems. The applications for these devices are in health (drug delivery, nano-surgical devices), energy (highly efficient and ultra-fast light gathering and energy transfer components and in environmental reclamation. A consortium is inexistence for this work. However, some key areas are absent:

Expertise offered: Biophysics, bio-photonics, ultra-fast laser and Synchrotron Radiation experience applied to biological samples.

Previous FP involvement: Yes

Details of Previous FP involvement: FP6 - as part of another consortium

Consortium status: In Europe: Biological Research Centre (Hungarian Academy of Science, Szeged, Hungary; University of Latvia, Riga Technical university; Soleil, the NLC and Biosciences: the US, The University of North West (Potchefstroom),

Expertise sought: A partner to act as the co-coordinator and engineering experience.

Related projects: FP6 International bilateral cooperation South African National R&D programmes

Title: Commercialisation of biodegradable packaging materials for use on export fruit

Acronym: Biopack

Submitted by:

Martin Taylor (martin@experico.co.za)

Tel: (021) 887 1134 Mobile: 082 886 7396

Postal Address: P O Box 7441 STELLENBOSCH 7599 South Africa

Theme: Nanosciences, nanotechnologies, materials and new production technologies

Focus Area: Integration of technologies for industrial applications

Type of project: R&D project, including technology demonstration (large scale)

Summary: With the increasing focus of global markets on consumer health and safety, as well as protection of the environment, there is a growing need to commercially utilise biodegradable packaging in the fruit export business. This is particularly important with regard to plastics. In fruit exports, plastic packaging is utilised to hold the product, to protect the product and to maintain fruit quality. The plastic packaging components used inside boxes therefore serves as a very important, and often misunderstood or under-estimated fruit quality management tool. This aspect is the most complicated factor that needs to be resolved for successful commercialisation of new plastic packaging items for use on fruit involves elements such as atmosphere modification (MAP), moisture management, temperature management and decay control. This applies for most fruit types exported from South Africa, including plums, nectarines, table grapes, apples and pears. Packing components implicated include grape carry bags, outer bag liners, punnets and where plastic boxes are used, the boxes themselves. The objective of this trial would be to link with companies with the ability to develop and produce biodegradable packaging for use in the fruit business. The role of ExperiCo would be to evaluate the efficacy of packaging provided by consortium partners on quality maintenance on fruit. Following successful development and testing in South Africa, the new packaging items would be commercialised by a process involving semi-commercial scale exports to selected offshore destinations. It will be possible for the consortium participants to use the research done in South Africa to procure global business.

Expertise offered: Development and application of new technologies on harvesting, handling, and storage of fruit freighted to distant markets. ExperiCo specialises in combining scientific research and development with the realities of commercial fruit handling. Web address: www.experico.co.za

Previous FP involvement: No

Consortium status: None

Expertise sought: Packaging manufacturers with development capacity and innovation focus; materials research organisations

Related projects: None

Title: South African Nanotechnology Initiative

Acronym: SANi

Submitted by:

David Britton (dtb@science.uct.ac.za)

Postal Address: Dept. of Physics University of Cape Town Rondebosch 7701 South Africa

Theme: Nanosciences, nanotechnologies, materials and new production technologies

Focus Area: Nanosciences and nanotechnologies

Type of project: Thematic network on specific research questions

Summary: The South African Nanotechnology Initiative (SANi) is a broad-based stakeholder group which serves not only a networking function, but also aims to coordinate activities with respect to representation of the SA nano-S&T research community particularly with regard to the leveraging of funds. Over the last three years SANi has worked with the SA government towards the development and publication of a national nanotechnology strategy which has led to a commitment of EUR 19000000 for the period 2006 - 2008. Although small compared to various European, Asian or North American nanotechnology strategies, this funding has provided an essential boost to the development of research and HR capacity allowing South African researchers to participate as equal partners in important niche areas. SANi has a membership of approximately 200 academic and industry scientists, students and technicians working in various aspects of nanoscience and nanotechnology. The active areas of research in South Africa have long been directed towards second generation nanotechnology applications of nanomaterials to socially important problems such as health, water and energy security, and industrial aspects, such as chemical and bio-processing, minerals and mining, and advanced materials and manufacturing. It is partly because of this existing expertise that the SA Government identified exactly these six areas as priority areas in its strategy document. At a higher level of detail specific research and development foci are on electronic materials, energy management, catalysis, electrolytic processes, membranes, nanotubes and fibres, strong materials, drug delivery and modelling. SANi has led to strengthened local collaborations in both academic and industry-academic in these areas and to the development of an applied research culture in the newly established Universities of Technology. Also, with a strong focus on IP development recent collaboration has led to the development of novel materials looking for applications and novel applications based on existing materials or modifications thereof.

Expertise offered: Various expertise in the synthesis, characterisation and applications of nanomaterials and nanostructures

Previous FP involvement: No

Consortium status: Over 200 members from all TEIs, other R&D organisations, and industry

Expertise sought: Other broad-based Nano-S&T interest groups and fora.

Related projects: South African National R&D programmes

Title: Inert nanoprecipitate strengthened metals

Acronym: inapresm

Submitted by:

David Britton (dtb@science.uct.ac.za)

Postal Address: Dept. of Physics University of Cape Town Rondebosch 7701 South Africa

Theme: Nanosciences, nanotechnologies, materials and new production technologies

Focus Area: Nanosciences and nanotechnologies

Type of project: R&D project (small scale)

Summary: Incorporation of inert species in a metallic matrix leads for precipitation of nanosized inclusions. Metal- noble gas systems have been long studied at a fundamental level mainly through TEM studies of ion-implanted samples. Most noble gases with the exception of He are known to crystallise in a close-packed structure epitaxial with the host matrix. The corresponding pressure in the nanoprecipitate can be inferred from various empirical equations of state to be in the region of several thousand atmospheres with the matrix experiencing an estimated shear stress typically one quarter of this pressure. With precipitates of several nanometres diameter, such a metal with a uniform distribution of inert gas precipitates would be an archetypal precipitate hardened alloy chemically identical to its pure form. From the discovery that large quantities of sputter gas can be incorporated, a process was developed in the 1980's at UKAE Harwell for storage of Kr-85 in copper and nickel released during the reprocessing of spent nuclear fuel. Typically the bulk material consisted of 2-5 atomic % Kr in the form of 3 - 5 nm precipitates embedded with the grains of a fine grained (nanocrystalline) metal. Recently we have reproduced and simplified the original Harwell process and are concentrating on the production of thick coatings and free standing films.

Expertise offered: Production of materials, microstructural and defect characterisation, mechanical and electrical characterisation

Previous FP involvement: No

Consortium status: None

Expertise sought: Sputter deposition of related materials, HR electron microscopy, applications

Related projects: International bilateral cooperation South African National R&D programmes

Title: Nanoparticulate silicon for printed electronic applications

Acronym: NanSi

Submitted by:

Margit Harting (mh@science.uct.ac.za)

Postal Address: Dept. of Physics University of Cape Town Rondebosch 7701

Theme: Nanosciences, nanotechnologies, materials and new production technologies

Focus Area: Nanosciences and nanotechnologies

Type of project: R&D project, including technology demonstration (large scale)

Summary: Silicon nanoparticles in the range of 30 - 200 nm are mixed with an inert binder to form an ink with a high volume fraction of particles. By printing (e.g. screen or transfer printing) a layer with interconnecting particles is formed to provide an uninterrupted path for carrier transport. In an additional approach, it has been shown that the electronic level of the nanoparticulate silicon layers can be changed by doping the semiconductor nanoparticles making it possible to use metallurgical grade silicon for device development. Combining the printing of the electronically active layer with the conventional printing of the inactive part of a device, it is possible to develop low cost consumer electronics. Based on this technology field effect transistor and diode functions have been proven successfully. A major South African project on the development of low power solar cells is ongoing. Other areas still to be developed requiring international collaboration include: 1. development of hybrid applications, e.g. combination of nanoparticulate silicon with organic electronic materials, or other material such as luminescent nanoparticles; 2. development and characterisation of semiconducting inks, including modelling of electrical behaviour; 3. electrical and structural characterisation of individual particles and their surfaces.

Expertise offered: Production of silicon nanoparticles. Printing of nanoparticulate semiconducting layers, using various techniques. Electrical and microstructural characterisation, including X-ray and synchrotron diffraction and ion beam methods.

Previous FP involvement: No

Consortium status: Possibly CSIR and iThemba LABS in SA

Expertise sought: Polymer chemistry, applications physics, electron microscopy

Related projects: International bilateral cooperation South African National R&D programmes

Title: Microbial Expression system for metal binding peptide production/display

Acronym: FEST

Submitted by:

Maureen Louw (melouw@csir.co.za)

Tel: +12 841 2167

Postal Address: CSIR Biosciences PO Box 395 Pretoria 0001

Theme: Nanosciences, nanotechnologies, materials and new production technologies

Focus Area: Nanosciences and nanotechnologies

Type of project: R&D project, including technology demonstration (large scale)

Summary: This technology relates to the development of an expression system for the surface display and production of peptides. This proprietary Gram-positive strain is able to over-produce and display chimeric gene products as heterologous peptide/protein fusions. This bacterium harbours the endogenous genetic background to over-produce the anchoring motif or carrier protein constitutively and continuously. In order to harness this ability as a surface display/expression system, a number of key genetic tools were developed such as gene targeted inactivation. In these genetic background peptides ranging in size from 5 to 40 amino acids can be inserted as in-frame fusions and expressed on the cell surface of this strain. An example included peptides encoding a poly-histidine tag which was incorporated as an in frame fusion and found to be successfully over produced and displayed on the cell surface. The peptide was shown to be functional through metal binding. These peptides can also be harvested. The expression system is currently being further improved by target inactivation of key proteases. This research has been under-pinned by fermentation optimization studies and defined media formulations based on cell mass production are in place. There are a number of advantages of this system: Gram-positive bacteria are robust and cell growth is not impaired by the production of chimeric gene fusions. Chimeric production is continuous and constitutive and an inducible promoter system is not necessarily required for over-expression. Small peptides are over-produced on the cell surface which facilitates peptide isolation. Integration of the chimeric peptide fusions into the host chromosome thereby ensuring that no heterologous plasmid DNA or antibiotic markers are present in the production strain.

Expertise offered: This technology can be applied in the development of bio-based functional materials from engineered self assembling peptides. The technology can be further developed for the production of metal binding peptides.

Previous FP involvement: No

Consortium status: None

Expertise sought: Development of new bio-based functional materials and where there is a need for a production system for metal peptides

Related projects: None

Title: Nanotechnology based drug delivery systems for proof of concept of new drug candidates

Acronym: NanDDoS

Submitted by:

Vinesh Maharaj (vmaharaj@csir.co.za)

Tel: 012 841 3295 Mobile: 082 4665466

Postal Address: P. O. Box 395 Pretoria 0001

Theme: Nanosciences, nanotechnologies, materials and new production technologies

Focus Area: Nanosciences and nanotechnologies

Type of project: R&D project (small scale)

Summary: CSIR Biosciences is a research-based biotechnology entity that provides solutions to improve health, fight disease and to support private and public sector industry in a manner that is sensitive to economic realities and the natural environment of the societies in which we live. The low rate of clinical entry of lead molecules is often related to lack of specificity, low efficacy and/or susceptibility to drug resistance. Various drug delivery approaches to improve the therapeutic properties of these compounds have been attempted. Following the FDA approval of the first protein nanoparticle based anti-cancer drug Abraxane, greater attention has focused on nanotechnology as one of the many emerging technologies in drug delivery. Over the past years, CSIR scientists have realised and discovered lead molecules from South African biodiversity samples e.g. plants for various therapeutic applications (e.g. cancer, malaria and inflammation) however many of these have bioavailability problems, lack specificity or have narrow therapeutic windows. As a result of these, the leads have not progressed further as part of the drug development cycle. The envisaged concept aims to apply nanotechnology-based drug delivery systems (DDS) at the development of these molecules in order to complete proof of concept to at least the pre-clinical stage. This concept note seeks to provide information to experts in the field of drug-delivery, polymer sciences, bio-conjugate chemistry and molecular biology who would be interested in participating in a flagship project. The anticipated outcomes (short and long-term) of this initiative are: Patented novel therapeutic agents or improved therapeutic use of compounds historically not of value, Knowledge dissemination through publication and conference proceedings; access to local and international funding, Establishment of a technology platform through collaborations and partnerships among the applied quantitative and biomedical disciplines, Opportunities for trans-disciplinary communication and training for a new generation of scientists capable of interacting across traditional technical boundaries.

Expertise offered: A comprehensive bioprospecting science and technology value chain to include gathering of indigenous knowledge and biodiversity samples, extraction and biological evaluation of samples, bioassay-guided isolation and characterization of new biologically active molecules, synthetic and medicinal chemistry for lead optimization, protein chemistry, enzymology, protein immobilization, structural biology, encapsulation technology and polymer sciences.

Previous FP involvement: No

Consortium status: None

CSIR collaborates with the National Cancer Institute in the US on discovery of new cancer leads from South African plants. We are in discussion with NCI on the application of nanodrug delivery systems

Expertise sought: Appropriate proprietary or emerging nanotechnology-based drug delivery systems for improving therapeutic potential of the drug candidateso preparation/formulation of investigational drugs with selected DDSo characterization of new drug-DDS complexeso In vitro and in vivo evaluation of the new drug-DDS complexes for appropriate therapeutic areas (e.g. malaria, TB, HIV, asthma, arthritis etc.)

Related projects: South African National R&D programmes

Title: Adding value to LAOs through inter alia nanocatalysis**Acronym:** LAO upgrading**Submitted by:**

Hermanus Vosloo (chehcmv@puk.ac.za)

Tel: 018-299-2358 Postal Address: School of Chemistry North-West University Hoffman street POTCHEFSTROOM 2531

Theme: Nanosciences, nanotechnologies, materials and new production technologies**Focus Area:** Integration of technologies for industrial applications**Type of project:** Networking between organisations in same area

Summary: The worldwide alpha-olefin market which is currently estimated at 2.6m Mtons/year could increase to 8m Mtons/year by 2010 according to various reports. There are currently eight alpha-olefin producers worldwide. Most of the current commercial linear alpha-olefin (LAO) plants produce even-numbered alpha-olefins based on ethylene oligomerisation while only a few is coal-based giving rise uneven-numbered LAOs. The largest end-use (ca. 50% in 2000) of LAOs is as polymerisation comonomers, synthetic lubricants (poly-alpha-olefins or PAOs) being the second largest consumer accounting for 85% of the consumption of 1-decene. Numerous other outlets for alpha-olefins exist of which the detergent alcohols (used largely in detergents and plastics) represent a prime example. In the detergent industry the perennial balancing act is between surfactant chain length, biodegradability and solubility. Traditionally linear alpha-olefins in the C12 to C15 range are used in the manufacture of alcohol sulphates. Longer chain surfactants leads to higher surfactancy and performance but is offset by low hardness tolerance and limited cold water solubility. Furthermore, controlled alkyl substitution in the middle of the hydrophobe chain produced surfactants that are biodegradable, highly soluble and more surface active. Such branching allows the use of chain lengths as long as C16 and C17 without incurring the historical negatives like lack of biodegradability. The aim of the project is to upgrade lower alkene feed stocks to detergent range alkenes and analogues through catalytic manipulation. Objectives: Design and synthesis of organometallic (pre)catalysts, involve molecular modelling to understand metal-ligand interactions along reaction pathways; synthesis of ligands and complexes aiming to modify the catalytic ability of the homogeneous catalyst and determine catalytic activity (proof of concept). Optimise catalytic reactions of new or improved catalytic systems. Study industrial applications i.e. tolerance to impurities in feeds; demonstration of scale-up possibilities, process simulation; heterogenisation of homogeneous catalysts and catalyst recovery using nano-/dendritic catalysis.

Expertise offered: The applicant is the programme manager of the Olefins Programme of the SA Department of Science and Technology and National Research Foundation Centre of Excellence in Catalysis (c*change). Members of the programme, their affiliation and fields of expertise are: Proff HCM Vosloo, S Marx, Drs CGCE van Sittert, JHL Jordaan and BB Marvey, North-West University. Organic and organometallic synthesis, homogeneous catalysis and molecular modelling. Prof JR Moss, University of Cape Town. Organometallic synthesis and homogeneous catalysis. Proff SE Mapolie, University of the Western Cape. Organometallic synthesis and homogeneous catalysis. Prof A Roodt, University of the Free State. Organometallic synthesis, kinetics and molecular modelling. Proff DBG Williams and J Darkwa, University of Johannesburg. Organic and organometallic synthesis and homogeneous catalysis. The laboratories are well-equipped for the research outlined in the proposal including the following equipment: 300-600 MHz NMRs, MSs and GC/MSs, X-ray diffractometer, GCs and computer clusters for molecular modelling.

Previous FP involvement: No**Consortium status:** None.**Expertise sought:** Organic and organometallic synthesis, membrane science, reactor design and computational science (molecular modelling).**Related projects:** International bilateral cooperation South African National R&D programmes

Title: Exploring the effects of nanoparticles on human health

Acronym: NANO EFFECTS

Submitted by:

Michelle Binedell (mbinedell@csir.co.za)

Tel: +27 31 2422366

Postal Address: CSIR PO Box 17001 Congella 4013 KwaZulu-Natal South Africa

Theme: Nanosciences, nanotechnologies, materials and new production technologies

Focus Area: Nanosciences and nanotechnologies

Type of project: R&D project (small scale)

Summary: The hazardous nature of nanoparticles is unknown. It is believed therefore that research on nanomaterials could assist in hazard identification by exploring lifecycle aspects of manufactured nanomaterials, their fate and transport as well as their routes of exposure to humans and other organisms, their toxicity and potential for bioaccumulation. Epidemiological and toxicological studies on the effects of particulate air pollution indicate that "fine" particulate matter (2.5 µm or less in diameter) cause pulmonary inflammation as well as systemic effects in humans (Pope and Dockery, 2006). It would therefore be important to study the toxicity and mechanisms of action of nanoparticles and their potential health effects. This project would involve clinical trials in order to determine the biological effects of nanoparticles on human and/ or mammalian cells. Scoping workshops with key national and international scientists in the field would be a critical first step in order to ensure that the most appropriate framework for nanotechnology research is developed.

Expertise offered: Facilities and expertise in conducting clinical trials to determine the biological effects of nanoparticles on human and/or mammalian cells

Previous FP involvement: No

Consortium status: None.

Interest from University of Pretoria - Medical Faculty

Expertise sought: Any expertise in health effects of nanoparticles. Possible partner at Cambridge University (Prof Anne Dowling)

Related projects: None

Title: Synthesis and characterisation of polymer-supported transition metal catalysts as novel materials for organic transformations

Acronym: PSTMC

Submitted by:

Gregory Smith (gsmith@science.uct.ac.za)

Tel: +27-21-6505279

Postal Address: Department of Chemistry, University of Cape Town, P.B. Rondebosch, Cape Town, South Africa, 8000

Theme: Nanosciences, nanotechnologies, materials and new production technologies

Focus Area: Materials

Type of project: Thematic network on specific research questions

Summary: The project aims to prepare polymer-supported catalysts bridging the area of homogenous and heterogeneous catalysis. The main objectives would entail the development of new ligand systems based primarily on alpha-diimines, immobilisation of selected transition metal catalysis on polymer supports and evaluating these immobilised catalysts. It is anticipated that immobilisation of molecular catalysts on polymeric supports will make them readily separable from reaction mixtures and facilitate recycling of catalysts.

Expertise offered: Extensive experience in metal complex synthesis (Schlenk techniques), application of organometallics to catalysis, dendrimer synthesis, analysis of organic/inorganic materials via spectroscopic techniques.

Previous FP involvement: No

Consortium status: None

Expertise sought: Polymer synthesis, catalyst testing

Related projects: None