Material and Chemistry

MATERIAL AND CHEMISTRY

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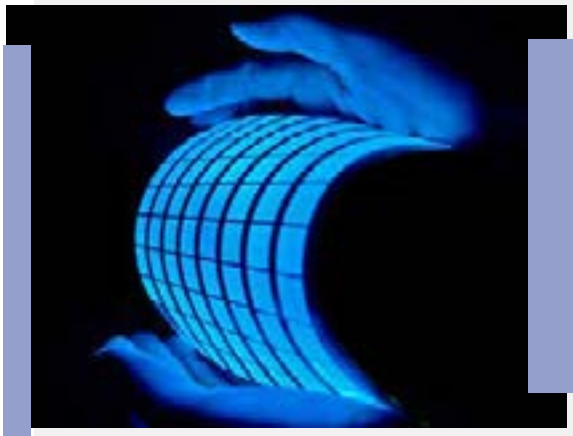
Benzotriazole Containing Donor-Acceptor Polymer as a Multipurpose Material



Syntesis of a Multi Colored Polymer

The invented material provides to observe all colors necessary for display technologies in a very small potential range.

Advantages

Donor acceptor type conducting polymer

Soluble in many organic solvents

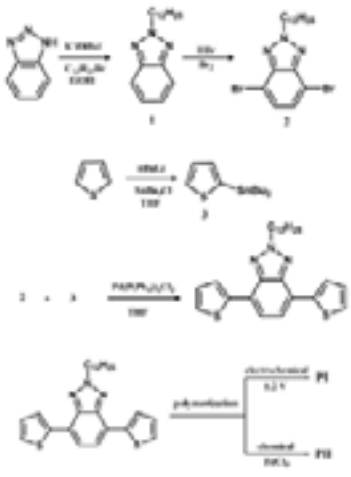
Wide application area (LEDs, solar cells, etc.)

P and N-dopable

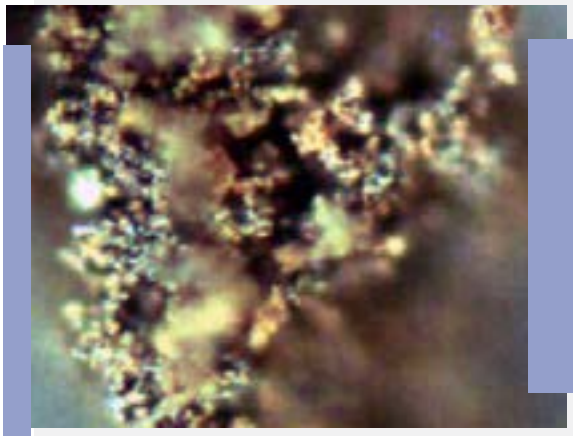
The resulting polymer has six distinct colors

This invention is about a material which provides to observe all colors necessary for display technologies in a very small potential range. The material is a derivative of benzotriazole containing donor acceptor type conducting polymer which is soluble, fluorescent and can be used in LEDs, solar cells, electrochromic devices, smart windows and many other technologies.

Development of a conducting polymer which enables the transition between all colors especially red, green, blue, black and transparent colors required in display systems, which is soluble in many different organic solvents, which is both p and n-dopable, which emits light & which is applicable on both LEDs and the active surface of solar cells are aimed.



A New Industrially Viable Method for the Production of Polycarbynes, Polymeric Precusors to Diamond and Diamond Like Ceramics



Artificial Diamond for Industrial Purposes

This invention is a technology which can produce artificial diamond, one of the hardest and durable materials in the world, with a few batteries and salt.

Advantages

Can be coated on a film surface

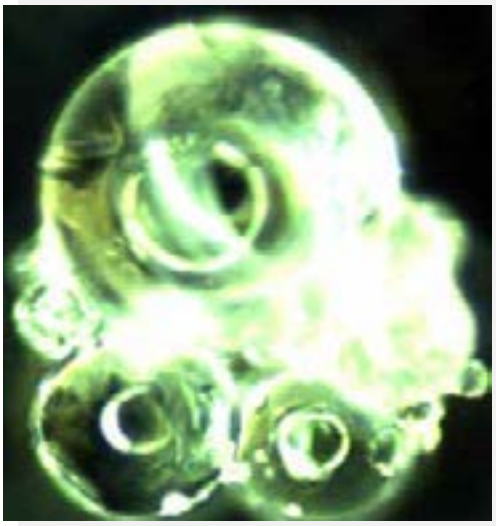
Scratch and chemical resistant

Low cost

Easy production

The synthetic diamond from the special polymer via an electrochemical method

Although artificial diamonds are used extensively in the industry, they are difficult to be produced and processed with the existing methods, and the cost is high. This invention produces artificial diamonds using simple electrolysis instead of dangerous and costly chemicals, and ensures that the required surfaces are coated in a diamond film.



Unique Processable Green Polymer with a Transmissive Oxidized State for Realization of Commercial RGB Based Electrochromic Device Applications

Synthesis of First Processable Green Polymer

The present invention highlights the synthesis of first processable green polymer with a transmissive oxidized state. Hence this material is the paramount candidate for the completion of RGB color space through commercial polymeric electrochromics.

Advantages

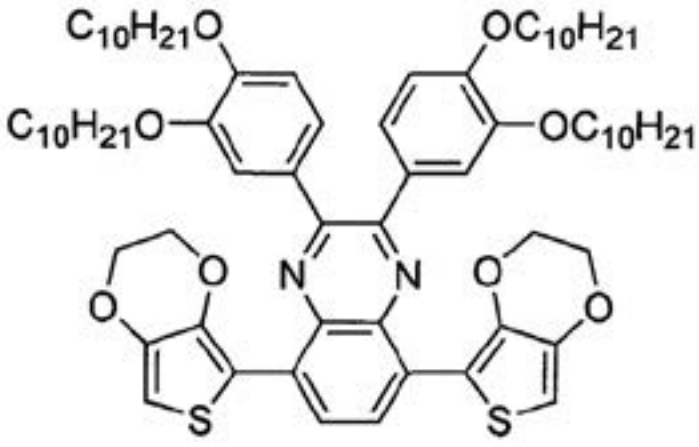
Synthesis of the first green polymer

Superior optical contrast

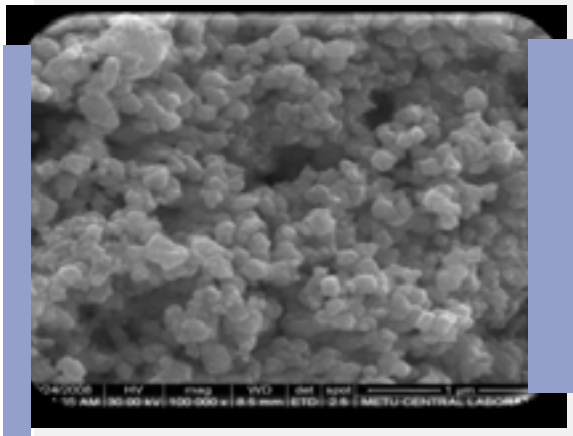
Excellent switching properties

Construction of display devices using RGB colored polymers

Development of the syntheses of first processable green polymer with highly transmissive colorless oxidized state with higher optical contrasts and excellent switching properties, obtaining the polymer revealed superior optical contrast in the visible region with fast switching times and high stability and obtaining the paramount candidate material for completion of RGB color space are aimed with this invention.



Production of Tungsten and Tungsten Alloys from Tungsten Bearing Compounds by Electrochemical Methods



From Scheelite to Tungsten

This invention is an alternative tungsten production technique. It is convenient to apply to scheelite mineral, economic and also suitable for nano powder production when compared to current tungsten production technique.

Advantages

Applicability to scheelite
The current tungsten production technique is more suitable for wolframite mineral

Easy and fast production
Tungsten production route by this invention is shorter and easier

Low cost
More economical when compared to current tungsten production technique

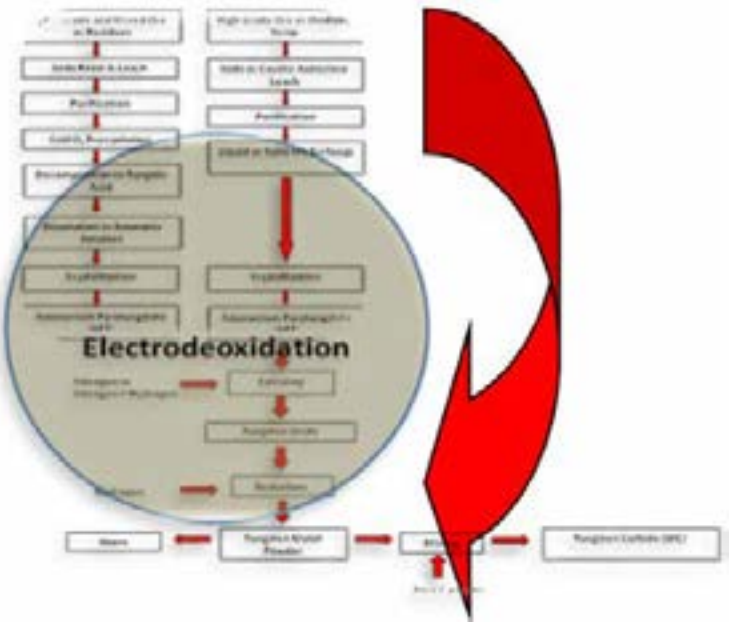
Nano powder production
Also suitable for nano powder production

Applicability to other metals
The invention can be applied to other metals having similar properties with tungsten (like Mo)

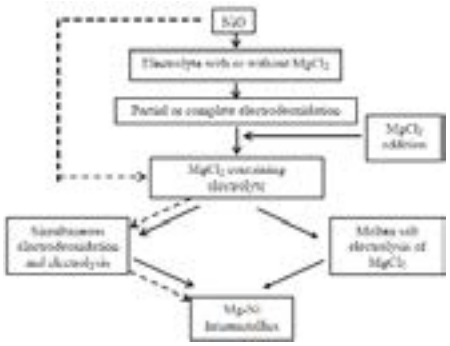
Tungsten powder production from scheelite mineral at one step

It is a new tungsten production technique.

According to the process described in this invention, tungsten is produced together with some calcium containing byproducts in molten salt solutions by electrochemical reduction of calcium tungstate in solid state. Metallic tungsten powder is obtained after a cleaning treatment in which calcium containing byproducts are removed by dilute HCl solutions.



Combination of Electrodeoxidation and Molten Salt Electrolysis Methods for Intermetallic and/or Alloy Production



Forming Intermetallics and/ or Alloys in Molten Salt

This invention provides a method for producing M1M2 or M1M2M3 intermetallics and/or alloys by combining electrodeoxidation and molten salt electrolysis techniques within the same electrochemical cell.

Advantages

Convenience
No need to produce metals forming the intermetallic separately

Economy
Cost effective when compared to processes where metals are produced separately

Purity
Electrochemically produced powders have high purities

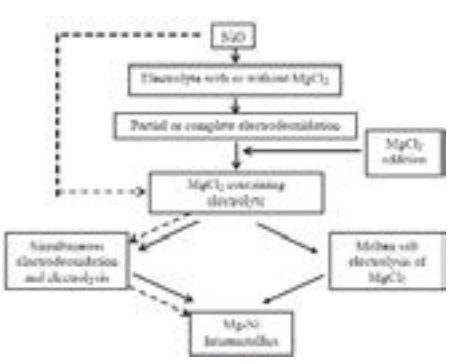
Small particle size
The powders, produced by combination of electrodeoxidation and molten salt electrolysis have small particle sizes

Safety
Mg forms an alloy just after its production in molten salt and is not in contact with air at any stage of the process. So, the accidents which are likely to happen during transportation, stocking, etc. can be prevented

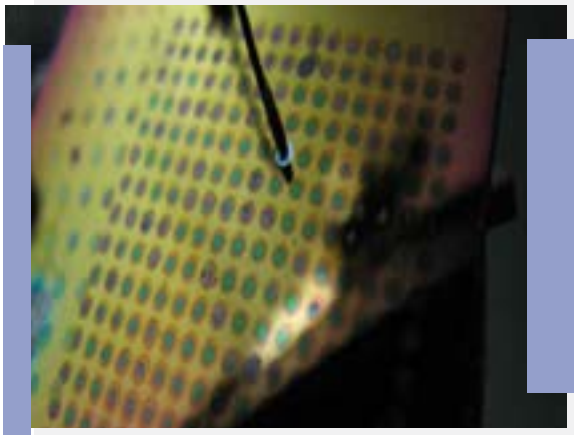
Formation of metals and intermetallics together

The most common methods for producing Mg_2Ni require the use of pure Mg and Ni as starting raw materials. This requires that these metals should have already been produced before intermetallic formation. Therefore, difficulties arise during handling, preparation, and processing due to highly reactive nature of magnesium.

However, $MgCl_2$ electrolysis was combined with electro-deoxidation of NiO within the same cell to form Mg_2Ni powder in this inventions. Instead of Mg and Ni, $MgCl_2$ and NiO were used as starting materials which leads to more economical and shorter production route. Moreover, electrochemical formation resulted in fine powder formation which is more suitable for hydrogen storage applications.



High Efficiency Silicon LEDs



Snatching Light from Silicon

Silicon, which forms the basis of modern electronics, unfortunately does not emit the light. On the contrary, its unique properties when produced in the nano scales can transform it into a lamp.

Advantages

Silicon-based
Driver circuitry and the light sources of optoelectronic devices are ready in a single fabrication

Low-cost
Production temperature is 250 °C. Number of LEDs to be produced is limited by the reactor dimensions

Efficient
Despite its low-cost production, it is among the highest efficiency Silicon LEDs reported so far

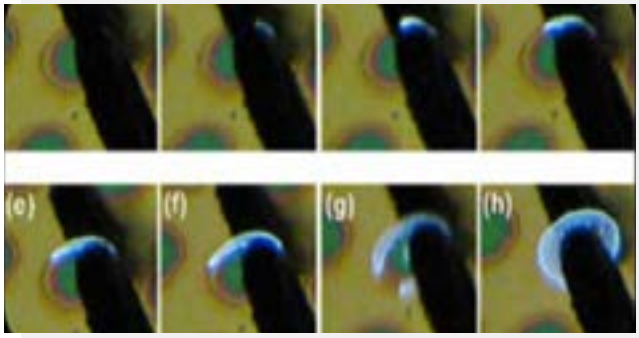
Multi-color
LEDs can be produced to emit light in any desired color including Infrared, visible, ultraviolet regions

Easy-to-produce
Quick and reproducible fabrication using PECVD system

Production of optoelectronic devices can be possible using only silicon

Although LEDs in the markets are very efficient, their fabrication processes are grueling and expensive. Moreover, due to their incompatibility with the Silicon processing technology they are integrated into display units using hybrid techniques, which leads to undesirable effects in performance and efficiency. Considering also the instability problems of OLEDs, our invention shines as it is low-cost with feasible dimensions, Silicon-based, stable and efficient.

Three Silicon based layers of suitable properties are deposited on Cr-coated glass. Indium-Tin-Oxide (ITO) is coated as the optical window. After the production is over, electroforming process is utilized under a calibrated forward bias. The light emission efficiency of the diode is enhanced by at least 30 times after this process. The color of the light can be adjusted by the deposition parameters of the Silicon layers.



Process for Preparation of Medical Grade Polyurethane Composites Containing Antibacterial Zeolite

Non-Microbial Materials

This invention covers the processes of micro and nano zeolites having antibacterial properties and the polymeric composites containing these zeolites. Preparation processes of both components are in the content of the patent.

Advantages

Nanotechnologic
Zeolite particles in micron or anno size

Antibacterial
Prevents the growth of microbes

Long term efficiency
Effects of ions may last for years

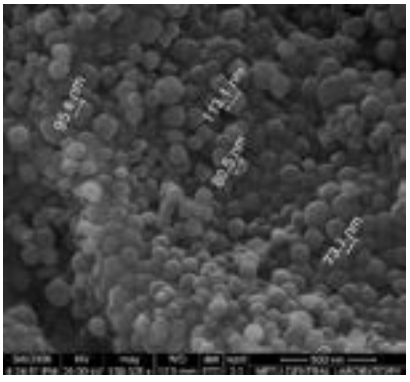
Variety
Can be prepares as powder, fiber, film or sponge

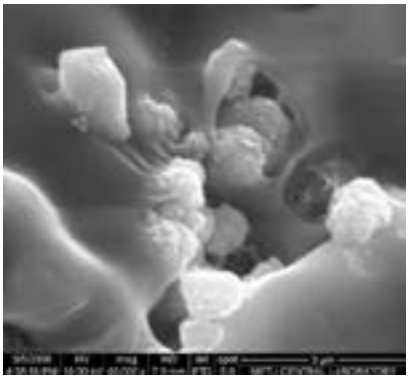
Hygienic
Provides clearness in every medium

Materials having healthy and hygienic property with long term efficiency

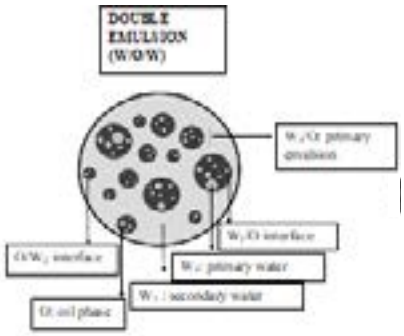
Polymeric material was prepared without using any other additive (initiator, solvent, chain extender, etc.) besides its main components. Zeolite powder was prepared in different forms as micro and nano particles and with high SiO_2/Al_2O_3 ratio, and made antibacterial with silver ions. Composites formed from these two components can be preparedin different forms as film, sponge or fiber.

Antibacterial powder can be added into detergents, polymeric composites can be used in textile (in upholstery fabric, socks); painting industry (in houses, vehicles such as cars, ships); as coatings (metal, ceramic, wood coatings); public places (internet cafés, toilets), paper industry (newspapers, paper money) and health (beds, walls, floors of hospitals, etc).





Production of Low Fat Ice Cream Using Multiple Emulsions



Production of Low Fat Ice Cream

In this invention, it was possible to reduce fat content of ice cream to 2.8% by using double emulsion method and to produce low fat ice cream having similar quality with regular fat containing (12%) ice cream.

Advantages

Less fat usage

Similar physical and sensory properties with regular one

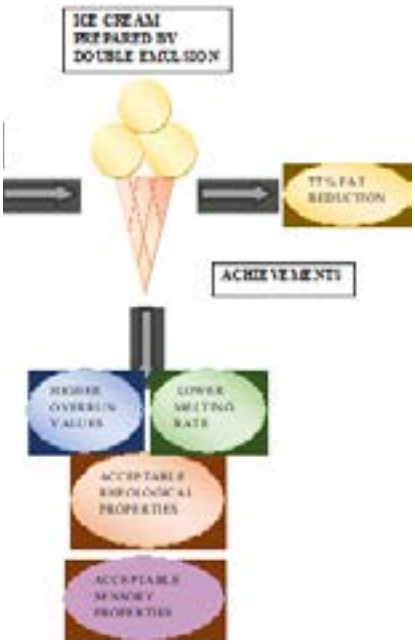
Natural food grade emulsifiers/stabilizers

Healthy and natural product for consumers

Reduction of fat content of ice cream

Water/Oil/Water type multiple emulsion was used in the design of low fat ice cream. Gum tragacanth, guar gum, lecithin and Polyglycerol polyricinoleate (PGPR) were used as emulsifier/stabilizer.

Low fat ice cream prepared by this method had similar physical (melt down resistance, overrun, rheological) and sensory (viscosity, mouth coating, acceptability) properties with regular fat containing (12%) ice cream.



Hemicellulose Based Antimicrobial, Antifog Biodegradable Film Capable of Removing Undesired Gases and Production Method Thereof

Make Use of Agricultural or Forestry Waste materials

The patent covers the production of hemicellulose based polymeric nano-composite film or coatings from agricultural or forestry waste materials.

Advantages

Anti-microbial under light

Anti-fog

Preventing the formation of various gases

Low oxygen permeability

Provides information for the production of hemicellulose based active packaging material

The hemicellulose based biodegradable film disclosed in the present patent contains photocatalytic titanium dioxide nanoparticles in addition to hemicellulose which gives the film antimicrobial, antifog, and gas removing properties. Therefore, the patent provides information for the production of hemicellulose based active packaging material.

In addition, the film is suitable for food packaging due to its low oxygen permeability.

Determination of the Real Number of Salmonella Pathogen

More Healthy and Safe

Provides cheap, fast, and exact enumeration of Salmonella bacteria for better treatment, more healthy nutrients, and living in more safe environment.

Advantages

Rapid
It is faster than traditional microbiology methods, 90h vs. 21h

Precise
It gives exact the number of Salmonella

Cheap
1 ml of recombinant plasmid solution allows 200 Real-Time

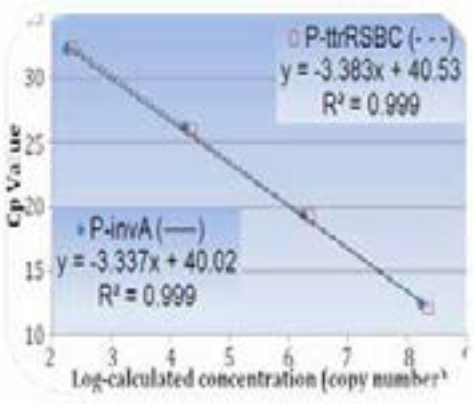
Easy to produce
Unlike genomic DNA, the descending solution can be produced in competent cells repeatedly

Practical
Constructed calibration curve is valid also for recombinant plasmids produced in competent cells

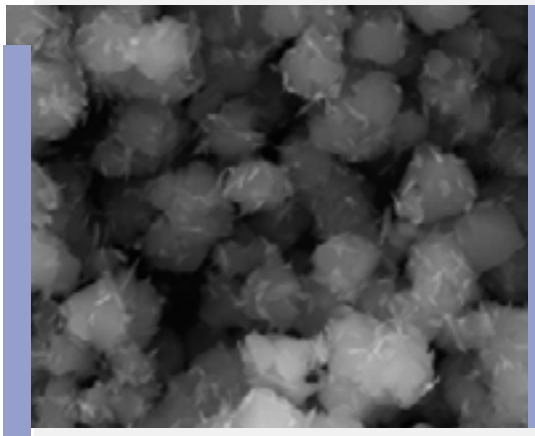
Recombinant plasmids are used as reference in real-time PCR

Beyond rapid detection methods, absolutely quantitative and cost effective methods that can enumerate low levels of Salmonella are essential for medical, veterinary, food, and environmental sectors. Up to now, only a few studies accurately enumerated Salmonella, but using genomic DNA as reference molecule for rapid and reliable Real-Time PCR technique.

Among reference molecules, plasmid DNA is the most attractive one, it is cheap, easy to produce and convenient. The developed method presents detecting and exact enumeration of Salmonella pathogen using two recombinant plasmids designed as Real-Time PCR reference molecules by cloning two most commonly used Salmonella specific target gene regions 'invA and ttrRSBC' into them.



Copper (II) Oxide Nanoparticles Decorated Zeolite and Their Production



CuO Nanoparticle-Zeolite Hybrid System with Enhanced Carbondioxide (CO_2) Adsorption Capacity

The developed hybrid system capture CO_2 in significantly higher amount than the just zeolite. The system also stores the CO_2 with physical and chemical bonds until its further use.

Advantages

Low cost

Potential to be prepared in an industrial scale

High CO_2 capture and storage capacity

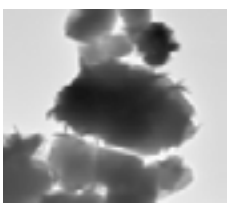
The release of stored CO_2 by simple heat treatment for the future use of the gas

Having the potential use in wide variety of areas in industry

Capturing and storing CO_2 gas in the medium effectively

Zeolite serves as a perfect material for gas separation and purification processes due to the ion exchange properties, adsorbing capacity, selectivity, and porous structure. Zeolites in molecular sieve form are often used in industry to capture various gases such as CO_2. Alternatively, metal oxides in nanoscale with their high surface/volume ratios are also very promising materials on adsorbing and storing gases like CO_2.

In this invention, new CO_2 adsorbing system has been developed by combining zeolites and CO_2. The CO_2 adsorbing capability has been significantly increased by synthesizing CuO nanoparticles on zeolite surface. Moreover, this system allows storage of the captured CO_2 gas by physisorption and chemisorption as well as the release of the gas by simple heat treatment for its further use. System can be produced with an economical method which can be applied in industrial scale.



Microscope images of CuO nanoparticle-zeolite hybrid system.

Microchannel Integrated Radio Frequency MEMS Biosensor

Radio Frequency MEMS Biosensor

No moving part providing robustness and reliability, high sensitivity, low-cost, integrable with autonomous and remote controlled systems.

Advantages

Rapid

Highly sensitive

Robust and reliable

Versatile

Low-cost

Integrity with autonomous and remote-controlled systems

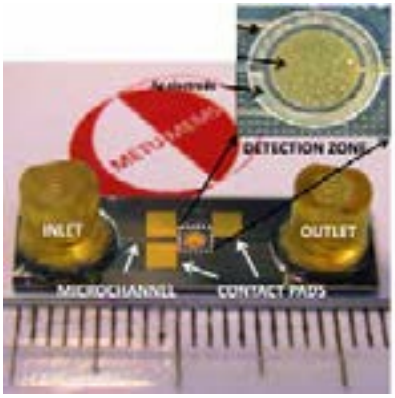
Exploiting RF waves for point-of-care, in-vitro, biological and chemical substance detection

This invention relates to a robust, microwave biosensor fabricated using MEMS fabrication techniques for highly sensitive and selective, rapid, label-free detection of biological or chemical substances.

The biosensor subjected to this invention can be used for In-vitro, Point-of-care diagnostics which can have wide range of applications covering environmental monitoring, drug-discovery, disease diagnosis etc.

RFSens

Microelectrochemical Sensor



On-chip Bacteria Detection

This invention presents an electrochemical sensor embedded in a microfluidic channel for fast and reliable detection of bacteria from a small amount of sample.

Advantages

Low-Cost
Less cost

More than one type of bacteria detection
Simultaneous detection of various bacteria types

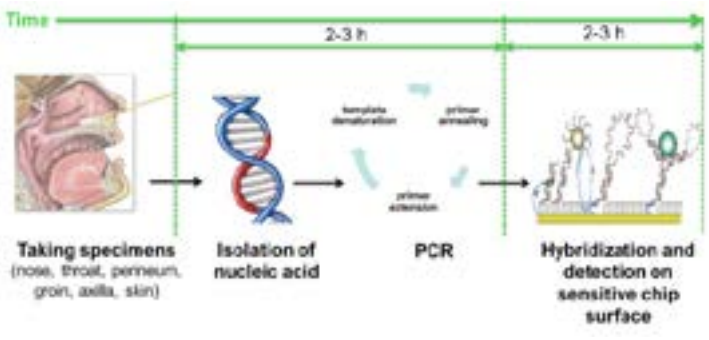
Portable
Integrated microfluidics approach provides portability of the whole detection system

Fast detection
Fast detection in less than 6 hours

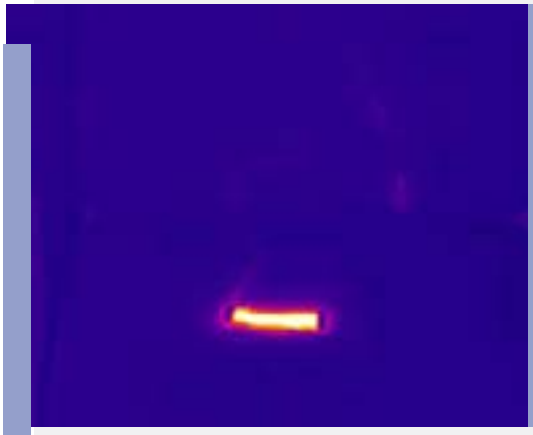
Wide applicability
Same device concept can be used to for other detection purposes where DNA based detection is required

Bacteria detection from a small amount of sample in a few hours

The industry needs disposable lab-on-a-chip systems for detecting various kinds of bacteria simultaneously in a time which is much shorter than the conventional counterparts. This invention allows detection of various kinds of bacteria in 3-6 hour with 3 electrode electrochemical sensor embedded in a parylene microchannel.



Metal Nanowire Decorated Heatable Fabrics



3D Coating on Fabrics with Dip Coating Method of Silver Nanowires

Decoration of silver nanowires as a 3D coating (that is breathable, flexible) onto cotton textiles, following which the coating can be heated through the application of direct current.

Advantages

Fabrics can breathe since they are not covered with a heating element

Very low amount of active material is required, thanks to nanotechnology

Simple dip and dry coating method is used for the fabrication, which is truly scalable

Operates under low currents and consumes very low energy due to high electrical conductivity of nanowires

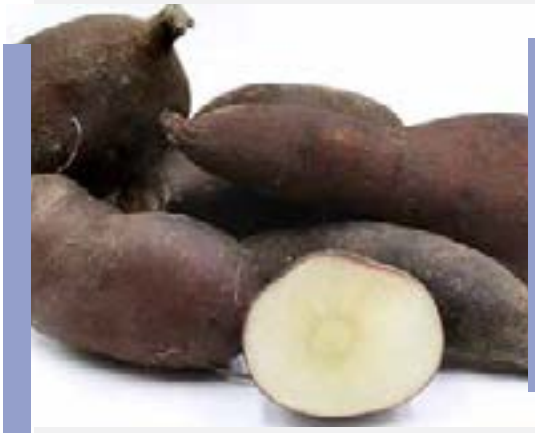
High temperatures can be attainable at low currents due to high thermal conductivity of nanowires

Fabrication of low power consuming, high performance heatable textiles

In this invention, metal nanowires are decorated onto textiles. Nanowires are then utilized as heating elements.

This coating does not limit the flexibility and breathability of the fabrics. It allows reproducibly heating the fabrics to 60 °C (maximum temperature for wearables), has high turn-on and turn-off response rates. Moreover, it can provide a constant temperature under direct current.

Chips Production Method from Ground Apple



Healthy Snack with Ground Apple

This invention is about snacks like chips and it relates to a method of producing chips from ground apple which has been developed in order to provide a healthy, delicious and low fat chips in the ready-to-eat food sector.

Advantages

Appropriate for diabetics

Healthy and delicious

Has a low fat content

Prebiotic effect

Healthy, tasty, low fat

In the development of the chip production method from ground apple; production of chips with low fat content, production of chips without starch content, production of chips by adding or not adding fat depending on the necessity and consumption of chips by diabetics are aimed.

The technology of the invention consists of a method in which ground apple is chopped and fried in oil or cooked with microwave energy. The ground apple chips which can be produced via two different methods, has little fat if fried in oil; and has no fat or starch if cooked with microwave energy. At the same time consumption of inulin, which is found in the natural structure of the ground apple, increases calcium absorption in the human body and plays a role in lowering the LDL level, which is known as harmful cholesterol.

Synthesis of Dolomite with $Ca(OH)_2$ and $Mg(OH)_2$ Nanodispersive Solution and Consolidation of Deteriorated Dolomite Stone by Forming Dolomite within the Stone

Consolidation of Dolomite by Forming Dolomite within the Stone

This invention provides consolidation of deteriorated dolomite stone by forming dolomite within the stone with the treatment of Ca(OH)2 and Mg(OH)2 nanodispersive solution prepared from dolostone itself.

Advantages

Compatible
A material that is chemically and mineralogically compatible with dolomite

Consolidant and Remedial
Improving the physical and physico-mechanical properties of the stone by regenerating dolomite in the weathered/weakened areas of dolostone; allowing stone having its original performance characteristics

Efficient
The nano solution can penetrate into the very fine pores and capillaries and all of the hydroxide nanoparticles in the solution are able to form dolomite by carbonation process

Easy production
$Ca(OH)_2$ and $Mg(OH)_2$ nanodispersive solution can be prepared in the laboratory in 2 days and this solution can form dolomite in 7-10 days

Non-destructive in-situ application
It is a treatment method which can be applied on site and does not give any damage to the dolostone itself

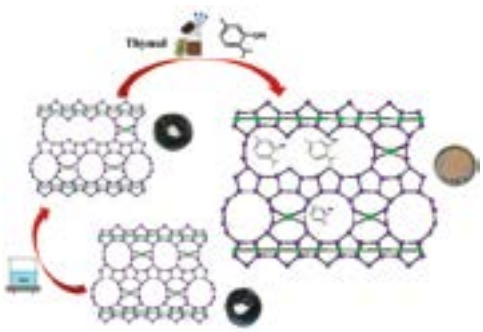
A unique nano dispersive solution to be used as remedial and anti-weathering consolidation treatment purposes for elongating the service life of dolostone

$Ca(OH)_2$ and $Mg(OH)_2$ (calcium hydroxide and magnesium hydroxide) nanodispersive solution was prepared from dolomite stone itself ($CaMgCO_3$ - calcium magnesium carbonate).

This solution was applied to deteriorated dolomite stone and carbonated within the stone under proper conditions (high relative humidity (90-95%) and high CO_2 partial pressure (pCO_2 ~ 0.4 atm)) to form dolomite. In this way, it will be possible to consolidate the historical buildings which are dolomite. The most important issue in this consolidation is to integrate chemically and mineralogically compatible material with the structure itself. Besides compability, physical and physicomechanical properties of weak stone will be improved and the application will be non-destructive and on-site.

That is a treatment based on strengthening the dolostone with a consolidation solution fully-compatible with its microstructure. It is a process something like regenerating the dolomite with its own stem cells.

Hierarchical antimicrobial zeolitic materials encapsulateed essential oils with increased thermal stability



Hierarchical antimicrobial nanoporous materials

Organic molecules to be used in different fields of industry as antimicrobial agents as an alternative to toxic inorganic elements

An antimicrobial powder agent has been developed to be used as an additive in making of surfaces, textiles, paints during the production stage for the purpose of removing undesired bacteria and pathogens. Instead of antimicrobial agents that are thought to be harmful, such as silver, an alternative compound with **high thermal resistance** was developed that is benign to **environmental** regulations.

Essential oils could not be utilized in applications due to difficulties in processing, as they have low thermal resistance and are volatile. It is known that the thermal resistance of these essential oils increases after they are encapsulated into a porous structure. However, it is expected that the pore size range required for placement thereto, needs to be similar to or larger than the size of these molecules. In this invention, the thermal resistance of these volatile organic molecules encapsulated into zeolitic materials, which have a hierarchical structure by expanding the pores, has increased, and so antimicrobial effect and antimicrobial duration have increased. In the invention, essential oil molecules were encapsulated in a hierarchical zeolitic material with the gas absorption technique leading to enhanced adsorption. In this way, it has been made possible to use organic volatile molecules as antimicrobial additives in various sectors, which was not possible due to difficulties in processing until now.

Advantages

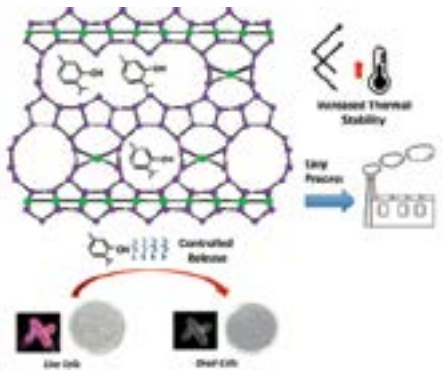
1. Thermal Stability: Higher thermal stability of essential oils with encapsulation process.

2. Controlled release: Controlled release of essential oils with encapsulation process.

3. Low cost: Low cost in the encapsulation process by using the desiccator method comparing with wet chemistry methods.

4. Practical in use: Easy use in the encapsulation process by using the desiccator method comparing with wet chemistry methods.

5. Ease of application: Easy process in industry.



Usage of Potash and Calcite as Additives to Natural Aluminasilicates for Direct Synthesis of Zeolite 3A and Zeolite 5A

Pore diameter adjustable zeolite synthesis

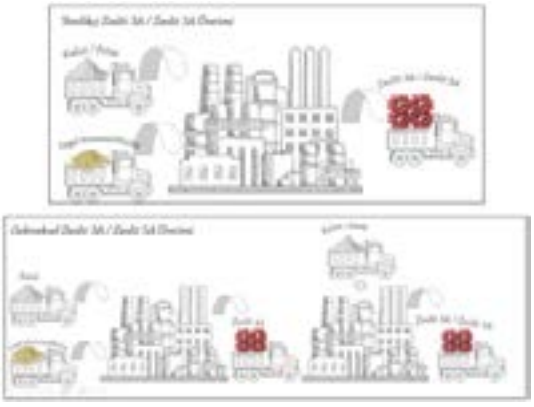
In standard production methods, additional ion exchange procedures should be applied to obtaion these zeolites while this production method is free of ion Exchange thus shoter, faster and cheaper.

Advantages

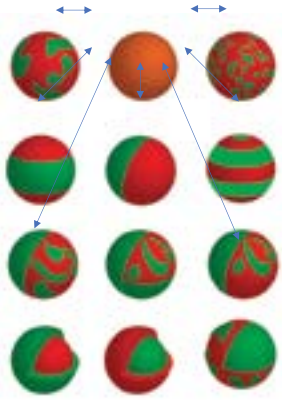
1. Lowering Process Steps
2. Faster Process
3. Lowering Equipment Costs
4. Lowering Production Costs
5. Ability to produce desired Na/Ca and Na/K zeolites

Direct, faster and cheaper production of zeolite 3A and zeolite 5A which is commonly used as dessicants and gas seperation process' in industry

Standard production of zeolite 3A and 5A consist of zeolite 4A synthesis which is the sodium form of the Linde Type A (LTA) family followed by the ion echange with calcium and potassium sources. This unique production method offers ion Exchange free production thus it is faster, cheaper and high quality final products.



Micro- and Nano-sized anisotropic particle production technique



Metalik anisotropic micro-, nano-particles

This invention enables the production of anisotropic particles from various metal alloys with high yield and scalability. Anisotropic shapes and compositions which can be produced include, but not limited to, Janus, patchy, striped, composite, core-shell structures.

Advantages

Useful: can be applied to various alloy systems, scalable

Visible: various morphologies can be obtained from the same alloy particles

Efficient: suitable for producing tens of grams of particles in a single batch. Standard techniques are used in particle production, there is no need for specially trained personnel with high skills.

High performance: tens of grams of particles can be produced in one batch

Sensitive: Similar morphologies can be easily obtained in significant portion of the resulting particles.

A novel method for the scalable production of anisotropic particles

Equilibrium microstructures that can be obtained by solidification of alloys are known. The present invention is based on the design of microstructures based on the solidification conditions of the particles, particle size, and/or external conditions. This invention focuses on the production of micro- and nano-sized particles in various morphologies and composition distributions depending on the solidification in equilibrium or nonequilibrium conditions, particle size and the external factors.