Detection System for Airborne Particles

Technology ID: 2007-08

Status: Patent Pending

Introduction: Currently there exists a critical need within the military for sensors and detection systems that are capable of identifying and quantifying airborne microorganisms and biowarfare agents. Moreover, monitoring of airborne particulates generated from industrial activities is a persistent environmental concern within private and public settings. The ability to collect, detect, identify and quantify bioaerosols and other particles suspended in gas in real-time is highly significant, particularly because there are a number of inferior, yet commonly used techniques.

Invention: The technology disclosed describes a detection system that is appropriate for collecting and detecting many different kinds of particles or particulates suspended in a gas. The collection surface of the detection system is not fixed, but is moveable and consists of a rolling tape which allows for collection and detection to occur simultaneously (continuous) or spatially decoupled (semi-continuous) at different sections along the tape. In addition to maintaining a clean collection surface, the collection tape would also serve as a physical archive of the collected particles, which could be reprocessed for later validation testing.

Advantages:

- Enables particles to be deposited into a smaller, more defined and concentrated area on the collection surface, which results in increased sensitivity
- Does not require a large collection surface area
- Adaptable electrode structure that can include wires, needles, cylinders or a knife edge to facilitate the collection of particles into a small area
- Provides high selectivity and sensitivity in the presence of interferents in gas streams
- Can achieve spore detection limits that are much lower than current bioassay techniques

Possible Applications: The proposed invention has many applications. It can be used for collecting and detecting particulates generated from industrial activities, or of biological origin such as bacterial and fungal spores that exist in the air as aerosols. This is particularly important for military, and industrial activities that are known to release airborne microorganisms and biowarfare agents that cause an increase in air toxicity within private and public settings.

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Detection System for Detecting an Analyte in a Fluid Medium

Technology ID: 2007-10

Status: Patent Pending

Introduction: Hydrogen cyanide (HCN) is a highly toxic compound produced in large quantities by industrial processes, pesticides, automobile exhaust and cigarette smoke. The toxicity is caused by the cyanide ion, which prevents cellular respiration. A variety of methods could be used to analyze water for cyanide, however these techniques are not as selective, sensitive or versatile as the disclosed technology. As such, there is still a need for an improved system for detecting cyanide and other analytes in fluid mediums.

Invention: The technology disclosed describes a new technique for detecting an analyte in a fluid medium using Fourier transform infrared (FTIR) spectroscopy. The detection system is comprised of a substrate that provides mechanical stability and is sized and shaped to intercept an infrared (IR) beam. The detection technique was tested varying substrate type, size and shape of the substrate, the reactivity of the reactive material and the type of spectrophotometer used. Furthermore, the detection system enables the infrared spectrum to be recorded directly on the material used to extract the analyte such that the analyte can be bonded strongly with the material. Consequently, the system does not require a high surface area absorbent since bulk chemistry can be accomplished with a thin reactive film.

Advantages:

- Enhanced sensitivity, remarkable speed and high level of detection selectivity
- Substrate provides mechanical stability and ease of handling of the combination of the substrate and reactive material
- Flexible reactive material coating can have any thickness, is infrared amenable and could also be deposited on the substrate using chemical, physical deposition or vacuum sublimation techniques
- Adaptable detection system can detect many different types of analytes in gas, liquid as well as aqueous fluid mediums

Possible Applications: The proposed invention has many applications. It can be used within the military and homeland defense for detecting, identifying and quantifying agents such as HCN. As such, the detection system could be used to trace both chemical and biowarfare agents in air and water. Additionally, monitoring of HCN generated from industrial activities is a persistent environmental concern within private and public settings. Furthermore, drinking water could be analyzed for cyanide using the proposed invention.

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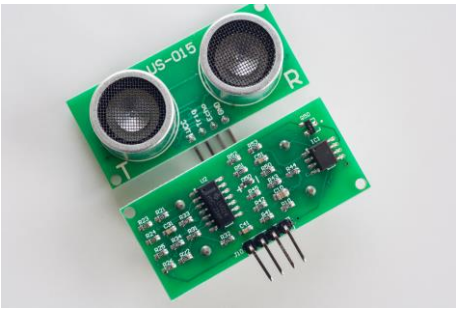
Acoustic Transduction Device and Acoustic Wave Sensor Technologies

Technology ID: 2007-21/2004-03

Status: Patent Pending



Introduction: Acoustic devices based on transducer materials operate on the principle of converting electrical energy to mechanical energy and vice versa in the presence of electrical fields or mechanical forces. Acoustic wave sensors typically work by monitoring and measuring frequency or phase changes of the wave in the medium being sensed. In the case of acoustic wave sensors, the detection mechanism identifies a mechanical or other change in the medium that it is immersed in; sensing and converting the change into an electrical signal - the strength of the converted signal correlating to the mechanical force associated with the change.

Acoustic devices and technologies continue to garner interest for applications in new and different fields. Piezoelectric materials are the common basis for acoustic devices. These devices are compact, easy to fabricate and use, cost-efficient to manufacture and have high performance capabilities. The devices, also, tend to be preferred for applications and systems in harsh environments where energy supply may be limited or non-existent.

Invention: The two inventions detail novel methods for fabricating and integrating acoustic sensors and devices in systems and applications. One invention contains innovative ways to fabricate a piezoelectric device with an integrated monolithic antenna for excitation purposes. Such a device is capable of exciting acoustic waves in another medium, such as a liquid or gas, which is in contact with one of the device's surface. The second invention consists of an acoustic wave sensor with the capability of generating lateral electric fields. The sensor detects shifts in the resonant frequency as a property of the liquid in contact with the sensor and correlates these shifts to the resonant frequency shift of the liquid.

Advantages:

Acoustic Device

- Enhanced sensitivity to mechanical and electrical property changes
- Single coil structure enables radiation of a time-varying electric field
- Capable of higher order harmonics operation and lower transmission losses

Acoustic Wave Sensor

- Improved frequency stability and reduced aging effects
- Greater sensitivity to mechanical and electrical property changes
- Detects changes in the liquid electrical properties of conductivity and relative permittivity of the medium

Possible Applications: These inventions would find applications in areas such as wireless communication devices, sensors deployed in harsh environments (e.g. underwater) and for powering devices such as body implantable medical sensors.

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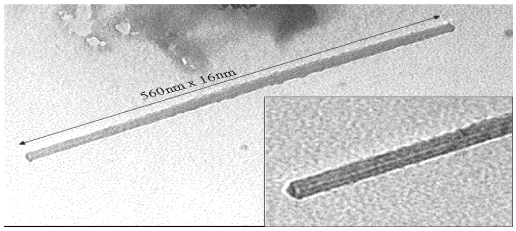
Carbon Nanotube Production from Plant Materials

Technology ID: 2008-31

Status: Patented (US 8632744 B2, US 8080227 B1)



Introduction: Significant investment currently exists in the industrial application of carbon nanotubes to a wide range of fields, such as energy storage and medical devices, due to this material's superior physical properties. The traditional methods used to manufacture carbon nanotubes (e.g., arc discharge, chemical vapor deposition, and laser ablation) have several issues that lead to decreased yields, high costs, and challenging process control.

Invention: The inventions describe novel processes that utilize the nanoscale arrangement of plant cell wall components to produce carbon nanotubes via controlled cyclic heating or flash-heating processes in an oxygen-limited atmosphere. Both single-walled carbon nanotubes (SWNT's) and multi-walled carbon nanotubes (MWNT's) can be produced from cellulosic plant fibers. These methods allow for lower process temperatures than those of traditional methods. The lower energy costs combined with the inexpensive starting material provide greater potential for scalability, which is especially important for applications that require bulk quantities of nanotubes, such as composite materials.

Advantages:

- Lower process temperatures
- Inexpensive starting material
- Potential scalability

Possible Applications:

- Energy storage
- Solar energy production
- Composite materials
- Medical devices
- Military applications

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Ring Grating Spectrophotometer

Technology ID: 2010-05

Status: Patent Pending

Introduction: Currently there exists a need for portable optical instruments that can be used to identify and analyze biological and chemical compounds. Moreover, the current spectrometer technology is high maintenance, requires sensitive detection equipment, complex and expensive alignment equipment, and time consuming alignment procedures in order to ensure effective operation. Although there are various spectrometer technologies currently available, an improved, multipurpose apparatus is necessary for conducting novel research and broadening applications.

Invention: The invention describes a spectrometer that is an improved modification of the conventional spectrometer in that it utilizes a cylindrically or spherically concave grating that concentrates monochromatic light to a straight line or point image. The proposed device seeks to provide effective adjustments to the current spectrometer technology to eliminate the need for extremely intense light sources, alignment equipment and associated procedures. Additionally, the invention resolves the alignment and sensitivity issues present in conventional spectrometers by using light-ring diffraction gratings that focus light into rings, an array detector to capture light from the entire ring and a computer to analyze the intensity and other aspects of one or more rings of light.

Advantages:

- Cost efficient, durable and portable
- Ideal for real time, onsite testing
- Hardware and software are customizable
- Ability to analyze one or more samples and properties or characteristics of a given sample
- Can perform multidimensional experiments.

Possible Applications: The proposed invention has many applications. It can be used in the drug identification, food inspection, environmental, medical and defense sectors. Additionally, the disclosed technology is useful in high school, college and industry labs, field research analysis of water or soil samples and remote sensor applications. The spectrometer also has various applications that include monitoring freshwater and marine ecosystems, protein characterization and space exploration.

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Novel Ionization Technique for Small Molecules

Technology ID: 2010-08

Status: Patent Pending

Introduction: A variety of technologies for the analysis of chemical compounds require the detection of ions. Although ions form naturally, it is sometimes necessary to facilitate ionization using a form of directed energy. Currently, a variety of ionization techniques are available for mass spectrometer (MS) analysis of different classes of chemical compounds. However, there exists a need for an ionization technique that eliminates the use of conventional electron ionization and chemical ionization sources which cause heating and out-gassing.

Invention: The invention describes a novel ionization method for the MS analysis of volatile and semi volatile organic molecules using radio-frequency (RF) signals. The method involves the use of a radiofrequency signal to ionize neutral organic molecules in the ultrahigh-vacuum region of a Fourier transform ion cyclotron resonance (FT-ICR) mass spectrometer. The technology disclosed demonstrates that the ionization of chemical compounds can be achieved with high efficiency through application of radio frequency energy to the compounds.

Advantages:

- Degree of ion fragmentation can be controlled which simplifies the MS analysis
- Improved signal/noise (S/N) ratios
- Versatility in mass spectrometer use
- Design and construction of the ion source is much simpler and more versatile
- RF ion sources can be low-cost, easy to use and require minimal routine maintenance

Possible Applications: The proposed invention has many applications. Applications for ionization include mass spectrometry, ion mobility spectrometry, and determination of molecular weight and/or bond energy of a target substance. Determining the chemical composition of volatile organic compounds (VOCs) has many analytical applications in diverse areas of research including disease biomarker detection, metabolomics, environmental sciences, explosive detection, forensics, and petroleomics.

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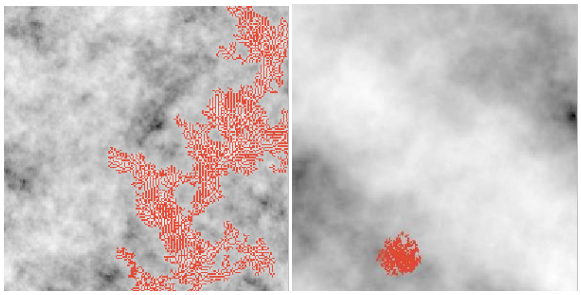
Early Breast Cancer Computer Aided Diagnostic System

Technology ID: 2012-17

Status: Patent Pending



Introduction: mammography has a low positive predictive rate ranging from 20% in women under age 50, to 60% - 80% in women age 50-69. Computer aided detection and diagnostic (CAD) methods are used alongside mammograms to aid in diagnostic accuracy and ongoing improvements represent an important focus in the field.

Use of CAD, however, is associated with decreased specificity and higher unnecessary recall rates. Additionally, the CAD image analysis methods available are exclusively concentrated on tumor detection providing no link between the method's quantitative output and the biophysics of the underlying system, and limiting accurate identification.

Invention: The disclosed CAD image analysis method investigates, as a function of time, the evolution of the biophysics of breast lesions and their environment. The inventors use 2D Wavelet-Transform Modulus Maxima (WTMM) to detect micro-calcifications in human breast tissue seen in mammograms by characterizing the fractal geometry of benign and malignant micro-calcification clusters.

Advantages:

- Non-invasive identification of identify cancerous or pre-cancerous tissue
- CAD Is insurance reimbursable, invested in by government and industry
- 80% of providers perceive CAD as the standard of care for screening mammography
- Approximately 40 million mammograms were performed in the U.S. in 2016

Possible Applications: The proposed invention cam be used to aid in diagnosis of breast cancer or the identification of precancerous tissue.

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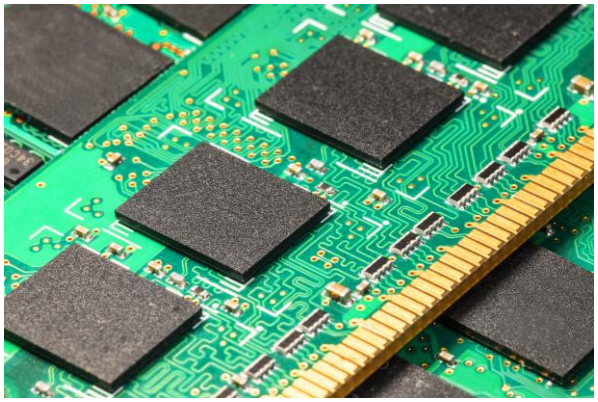
Active Exploiting PCM Write Asymmetries to Accelerate Write

Technology ID: 2012-19

Status: Patent Pending



Introduction: Phase Change Memory (PCM) represents the next generation solution for fast read / write / storage of flash memory solutions. The technology is more reliable and over 100x faster than conventional techniques used in flash memory. PCM has the additional advantage of permanently storing data even with loss of power. As the overall market is trending towards lower power consumption memory modules, PCM architecture's lower current and higher speed read / write capability allows closer alignment of memory and CPU ecosystems, from an operational and physical standpoint.

PCM technology, as is currently used, has a major weakness - slow data write speed. The source of this problem is the characteristics of the chip material that cause writing a "1" data bit to be slower than writing a "0" bit. Therefore, the speed of writing a bit sequence is limited by the total number of "ones" that need to be written. The chip also requires more electrical current to write a zero than a one. As a result, the number of zeros limit the number of PCM cells that can be written concurrently.

Invention: This invention seeks to improve the performance of PCM by group sorting the ones and zeroes together into separate bundles to optimize the write speed and reduce power consumption. It proposes a new scheme for writing to memory - a two stage write. Here, leveraging the speed and power asymmetries of writing a zero bit and a one bit are taken into account. Writing a data block to PCM is divided into two separated stages, i.e., write 0 stage and write 1 stage. Without violating power constraints, all zero bits in this data block are written to PCM at an accelerated speed during the write 0 stage while during the write1 stage, all one bits are written to PCM, with more bits being written concurrently. This new coding scheme improves the overall speed of the write1 stage by increasing the number of bits that can be written to PCM in parallel while reducing power consumption.

Advantages:

- Provides for significant improvement to system performance of around 33.9% on average
- Reduces memory latency when compared to standard PCM by 68.3%
- Two-stage write process shows 16.5% latency reduction and 9.2% performance improvement over FlipNWrite scheme
- Lower energy-per-bit and increased cell storage capacity

Possible Applications: The proposed inventions would find application in memory devices used in smart phones, tablets, and other smaller devices where low power consumption is a key consideration. Its superior performance in terms of reduced latency would also make it suitable for applications requiring very high-speed communications between the processor and memory elements.

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Microscope Illumination System

Technology ID: 2013-07

Status: Patent Pending

Introduction: Lighting plays a critical role in enhancing images for viewing and photography. Although there exists a need for an illumination system that is capable of providing high resolution, close-up imaging of small specimens, a variety of lighting instruments and methods are available for imaging and/or accessing small specimens. As such, various modifications and additions such as diffusers, variable intensity light sources, positioning adjustments and annular light rings have been incorporated into currently used imaging equipment.

Invention: The technology disclosed describes an adjustable lighting apparatus and methods adaptable for light microscopy, photomicrography, and macrophotography. The proposed device is an improved lighting apparatus compatible with imaging small specimens for viewing or photographic purposes. Additionally, it is used for simultaneously projecting light onto specimens from opposing light sources at varying distances and angles. This is necessary for observation of small objects where distinct control of light direction, intensity, and distribution directly impacts observation quality and object clarity. The disclosed technology is a multipurpose laboratory and microscope light designed to provide various levels of illumination for a variety of lighting applications.

Advantages:

- Adjustments are multi-purposed, sensitive, adjustable, flexible
- Adjustability provides a variety of illumination options as well as easy access to the specimen
- Ability to obtain high resolution, high contrast images of specimens

Possible Applications: The disclosed technology may also be used by scientists in the areas of entomology, engineering, ballistics, and anthropology. The disclosed technology may also be used by jewelers to inspect gems for quality and value. Additionally, contamination control professionals can use the proposed invention to analyze substances to address contamination issues in a given area.

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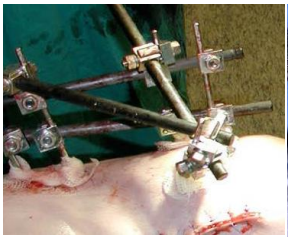
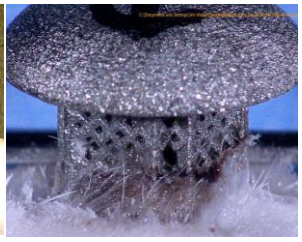
Reduced Infections with Porous Transcutaneous Implants

Technology ID: 2013-12

Status: Patent Pending





Introduction:

Surgical realignment of bones following skeletal fractures requires external hardware to fix the bone in place until the bone heals and is self-supporting. Such transcutaneous hardware includes metal rods that are affixed to the bone, protrude through the skin and are attached to an external hardware system. As the rods remain in place for weeks, the site where a rod passes through the skin and soft tissue can often become infected. At least 16% of orthopedic external fixation patients contract such infections, requiring additional hospitalization and resulting in an estimated annual health care cost of over $1billion. Reducing such infections is of significant importance.

Invention: Experts at The University of Maine have developed a biocompatible 3D printed and highly porous implant for use in place of a smooth metal surface at the transcutaneous site. The high porosity promotes in-growth of surrounding cells, creating a biological seal at the tissue-implant interface. This seal prevents pathogenic entry at the site, thereby reducing or eliminating infection. Further, as the skin eventually fuses to the porous fixator pin, scar tissue is not generated. Thus, upon removal, a fresh wound would be generated which could potentially allow quicker healing times with reduced complications and scarring.

Advantages:

- Reduces infection rates and hospital stay
- Animal studies successful - no infection/rejection, clear in-growth and vascularization, soft tissue attachment in under 1 week
- Aging population increases relevant patient population (rheumatoid arthritis, osteoarthritis)

Possible Applications: To reduce infection rates at orthopedic external fixation sites.

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Composite Building Products Bound with Cellulose (No Added Formaldehyde Wall Board)

Technology ID: 2013-13

Status: Patent Pending

Introduction: Wood composite products are commonly used as building products and for consumer goods such as furniture, shelving, and toys. Typically, the panels are constructed by binding wood chips, flakes, sawdust, or pulp using a resin binder under pressure and heat. The result is a durable, lightweight, and versatile panel made of renewable material. However, because the resins traditionally used for such products are urea-formaldehyde based due to their low cost and fast curing time, off-gassing is a significant health concern since formaldehyde is considered toxic.

Although ultra-low emitting formaldehyde and less toxic binders do exist in, there are concerns about inferior performance as well as other environmental factors regarding additives, manufacturing processes, and biodegradability. Therefore, as environmental concerns grow, binders and technologies that prove to be fully renewable and biodegradable without reducing the material properties of the finished products are becoming highly desirable.

Invention: The invention describes a novel fiber board building material using randomly oriented cellulose nanofibrils (CNF) as the binder instead of conventional resin binders. The CNF slurry (comprised solely of CNF particles and water) impregnates, bonds, and reinforces the wood particle base material (e.g., wood shavings, wood meal, saw dust, etc.) using a process that is free from harmful chemicals or additives. The end product is a versatile, 100% bio-based composite that is entirely renewable and biodegradable while having impressive strength and stiffness properties suitable for many applications.

Advantages:

- All materials are 100% renewable, biodegradable, recyclable, and nontoxic
- Completely eliminates the need for a resin-based binder system, reducing health problems associated with formaldehyde exposure
- Can be fabricated utilizing existing production techniques and systems
- Up to 25% increase in material strength
- 20–1000% increase in fracture toughness

Possible Applications: The proposed invention is suitable for many applications. It can be used for the production of engineered wood products, including particle board, wallboard, oriented strand board (OSB), medium-density fiberboard (MDF), and high-density fiberboard (HDF).

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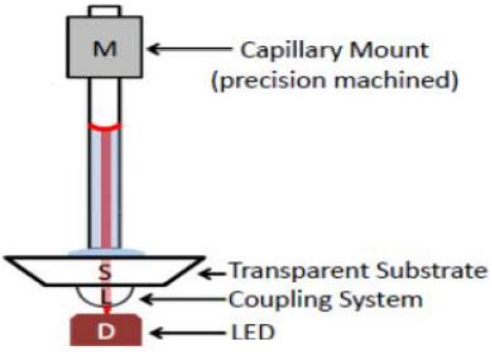
Microviscometer for Diagnosis of Pancreatic Cancer

Technology ID: 2014-08

Status: Patent Pending



Introduction: Biomedical imaging has resulted in greater detection of pancreatic cysts, however, per the American Cancer Society, the only way to confirm a diagnosis of pancreatic cancer is through biopsy of the suspected tissue. Such techniques require a fine needle aspiration of cyst fluid for analysis. The fluid is analyzed for tumor markers, various chemistries and viscosity. While viscosity of cystic fluid is correlated to the malignant potential and stage for certain cancers, due to the limited data provided by currently available viscometers, this simple method of determining malignancy has gone largely unutilized.

Invention: Inventors at The University of Maine have developed and tested a new method and instrument - a microviscometer - for diagnosing and staging early pancreatic cancer. The invention makes use of the viscoelastic properties of cystic fluids, which have been shown to correlate with cyst type, malignancy and stage. Unlike previous approaches that require large fluid volumes extracted only from sufficiently large cystic tissues, this instrument is capable of determining complete viscosity versus shear curves using only a few microliters of fluid.

Advantages:

- Procedure is completed in the OR, no technician required which saves clinician time
- Based on an inexpensive design
- Requires only 10 µl of cystic fluid versus at least 200µl using current diagnostic methods
- Reduces the cost while improving accuracy
- Can measure other biofluids for diagnostic use (synovial fluid for joints, perilymph for ear)

Possible Applications: Cancer diagnostics

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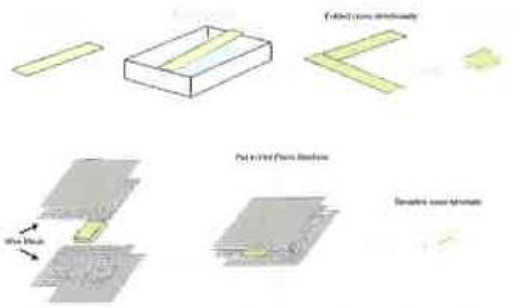
"Cellubound" Composite Products of Paper

Technology ID: 2015-11

Status: Patent Pending



Introduction: Laminated paper composites are typically constructed by saturating layers of kraft paper in an adhesive binder and curing at high heat and pressure to form the panels. The result is a durable, lightweight, and versatile panel made of renewable paper material. However, because the resins used for such products are traditionally urea-formaldehyde based due to their low cost and fast curing time, off-gassing is a significant health concern since formaldehyde is considered toxic.

Although ultra-low emitting formaldehyde and less toxic binders do exist in, there are concerns about inferior performance as well as other environmental factors regarding additives, manufacturing processes, and biodegradability. Therefore, as environmental concerns grow, binders and technologies that can prove to be fully renewable and biodegradable without reducing the material properties of the finished products are becoming highly desirable.

Invention: The invention describes a novel laminated paper composite material and method of manufacture using randomly oriented cellulose nanofibrils (CNF). In place of conventional resin binders, the CNF slurry (comprised solely of CNF particles and water) impregnates, bonds, and reinforces the paper sheets, which can be laid up in different stacking sequences (unidirectional, cross, angle) depending on the application and desired properties. The laminate is then cured using heat and pressure. The end product is a new bio-nanocomposite laminate system that is entirely renewable and biodegradable while having impressive strength and stiffness properties suitable for many applications.

Advantages:

- All materials are 100% renewable, biodegradable, recyclable, and nontoxic
- Completely eliminates the need for a resin-based binder system, reducing health problems associated with formaldehyde exposure
- Can be fabricated utilizing existing production techniques and systems
- Orthotropic or anisotropic properties possible for specific applications
- Excellent strength to weight ratio

Possible Applications: The proposed invention has many applications in several industries, including the automotive and aerospace (interior panels), marine (backer boards), consumer product (cutting boards, countertops), furniture/casework, architecture (decorative surfaces), and packaging industries.

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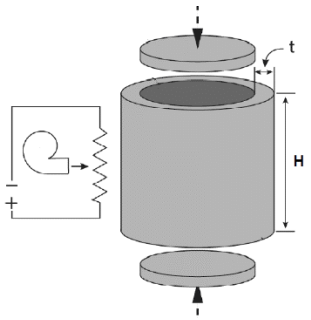
Controlled Porosity Structural Material with Nanocellulose Fibers

Technology ID: 2015-16

Status: Patent Pending



Introduction: Since its initial discovery in the early 1970s, nanocellulose has been studied extensively. With recent advancements in the field of nanotechnology, new and diverse potential market opportunities have arisen, resulting in significant global research to discover new applications and processing methods.

Nanocellulose is most commonly obtained from wood pulp or cellulose stock, by which fibrous cellulose is pre-treated and processed to separate the bulk fibers and eventually create nanoparticles of cellulose with high aspect ratios. The properties of the nanocellulose are controlled by the pre-processing treatment, the amount of water that remains in the polymer after synthesis, and the post-processing procedures. However, traditional dewatering processes typically rely on heat, air, and gravity, which tend to be inefficient and can often result in inconsistent and unreliable properties.

Invention: The invention describes a novel method of dewatering saturated nanocellulose after production. This method utilizes a porous dewatering material along with hydrostatic and evaporative processes to rapidly create nanocellulose products. Additional steps such as freeze drying or vacuum drying can also be used to further remove water. The processing parameters can be adjusted to fine tune the density, porosity, pore size distribution, biocompatibility, hydrophobicity, and dissolution kinetics.

Advantages:

- More reliable and precise control of porosity
- Improved processing efficiency
- Scalable for manufacturing large amounts of nanocellulose
- Can be used to create biocompatible and/or biodegradable compositions
- Additives can be incorporated to alter physical/chemical properties

Possible Applications: The proposed invention has many applications due to the unique properties of nanocellulose. Potential applications include paper and paper-based packaging, biomedical and biocompatible materials (structural nanocomposites), energy storage (batteries and capacitors), and food additives.

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Navindor - Hybrid Multimodal Indoor Localization and Tracking

Technology ID: 2017-01

Status: Patent Pending

Introduction: Modern GPS navigation systems have several drawbacks that must be mitigated with a variety of strategies. One of the most common drawbacks is that over a large area, GPS accuracy can be off by a significant margin so as to make navigation unfeasible. Additionally, GPS fails almost completely indoors, where line-of-sight (LOS) to the satellites required for GPS is difficult or impossible to obtain. Even when signals are available in these situations, the power required to capture and interpret signals goes up considerably due to interference from structures, leading to significant battery drain in devices used for GPS mapping (e.g. cell phones and portable GPS units). The inability to obtain GPS signals indoors is an issue when navigating large, complex and unfamiliar areas such as hospitals, shopping malls and college campus buildings. In these situations, existing wireless access points (AP) acting as waypoints can be leveraged to assist in approximating the user's location and providing directional guidance. However, this technique also has deficiencies such as varying and uneven signal strength from different AP along with signal interference and network congestion issues.

Invention: The University of Maine team has created a technique that utilizes multiple types of location beacon information to more accurately determine location information. The technique combines data from different types of radio inputs, like Wi-Fi, RFID, and Bluetooth signals to create an average that converges towards the actual location at a higher accuracy than any one set of data on its own. As a user moves closer to or further from one of the signaling devices, the change in signal strengths are measured and compared to previous measurements. When plotted onto a third-party map, and then paired with navigation software; a user can get a course to a destination while avoiding known obstacles and accounting for items like emergency door locations.

Advantages:

- The technology offers a more granular and accurate location determination capability through the use of multiple beacon devices
- Multiplexing of several types of signals when calculating approximate distances is possible for greater precision and accuracy
- Enables adding other types of signals to the mapping mix to refine location data
- Provides additional value by highlighting special items such as emergency exits or heavy traffic areas

Possible Applications: Areas where high prevalence of multiple types of signal data exists and can be leveraged efficiently for navigation purposes. Examples would be warehouses where Wi-Fi and RFID tracking systems are deployed and additional navigational enhancements provide increased value.

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Method to Reduce the Shrinkage of Semi-Crystalline Polyolefins During Fused Layer Modeling

Technology ID: 2017-04

Status: Patent Pending

Introduction: Polyolefins such as polypropylene (PP) and high-density polyethylene (HDPE) represent a nearly half of the consumed thermoplastics globally and have various applications spanning several industries. However, even as three-dimensional (3D) printing material and technology developments have surged over the years, PP has not been widely utilized for additive manufacturing processes such as fused layer modeling (FLM) 3D printing. This is mainly due to challenges stemming from material shrinkage, which results in dimensional instabilities. Although a commercial PP filament is available in today's market, inorganic fillers are used to enhance the stiffness of the polymer, and still, the physical properties are poor, making it unsuitable for many applications. Additionally, the inorganic fillers are not easily recyclable and non-renewable, making them incompatible with "green" manufacturing initiatives. Thus, polyolefin-based filaments with reduced shrinkage, improved physical properties, and that are more environmentally friendly could be revolutionary to the FLM printing market.

Invention: The invention describes PP filament formulations with reduced shrinkage for FLM processing. The formulations include a polymer blend made of PP and HDPE, an impact-modified PP copolymer, and a PP random copolymer. The polymers are made into filaments using an extruder, and cellulosic nanofibers can be added during melt compounding to further enhance the mechanical properties of the printed parts.

Advantages:

- Enables reliable printing of PP parts by reducing shrinkage
- Stronger, lower cost, lighter, and more renewable than the only existing PP filament on the market
- Can utilize recycled PP and PE, which represent the majority of consumed thermoplastics
- Increases the value of polyolefins and lowers the cost of the commercial filaments
- Cellulosic nanofibers can be added to further enhance the mechanical properties

Possible Applications: The proposed invention has many applications as a 3D printing plastic filament, including automotive components, aerospace components, packaging, consumer products, and medical components. It can also be used as an alternative to glass fiber reinforced plastics.

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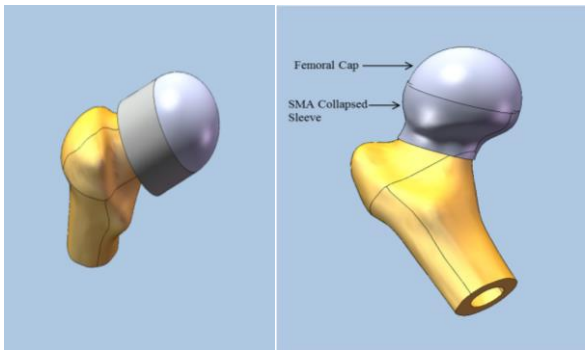
Ware-Resistant Stemless Hip Using Smart Materials

Technology ID: 2017-08

Status: Patent Pending



Introduction: Surgery to replace the hip joint with an artificial joint is a common procedure globally due to its resulting success, pain relief, and near normal functionality. Despite its success, however, complications can affect the implant longevity, causing high number of revision surgeries, which are the most significant long-term outcome for total hip surgery. Such complications include failure due to corrosion, physical ware, infection, and loosening of stems. Revision surgeries are difficult, less predictable, dangerous, expensive due to expertise and special equipment required, and don't guarantee longer performance than the original surgery and implant.

Invention: Researchers at the University of Maine have developed a stemless hip replacement prosthesis in which a femoral neck sleeve is designed from shape memory alloy/polymer that, once heated, shrinks and wraps around the femoral neck. This unibody design eliminates friction between multiple components found in traditional implants such as Birmingham implant that often leads to complications. Further, the design also preserves the femoral head and neck by providing rigid support, thereby avoiding the requirement for the peg that is typically drilled into the bone for stability in traditional hip replacements, and can lead to neck fracturing and notching among other complications.

Advantages:

- Increased longevity, reduced implant failure rate
- Biocompatible, corrosion resistant alloy
- Simplified, safer procedure, no pin required
- Minimized bone loss from stress shielding
- Growing market driven by new materials use

Possible Applications: Total Hip Replacement

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Remote Control Polarization System for Aerial Photography

Technology ID: 2017-09

Status: Patent Pending

Introduction: Unmanned aerial systems (UAS) are finding use in an increasing number of commercial and defense related applications. One of these applications is image and video acquisition. Given the extensive development of applications and opportunities in this space, there is a greater interest in managing the quality of the images through manipulation of attributes such as exposure time, ISO, camera aperture, and image or video format. With these options, image capture can be enhanced to enable better adaptation to changes in lighting, subject, and other factors.

The use of polarization-dependent optics in photography and videography allows for improved selection of the target, increased color saturation, and balancing of the intensity of the sky with that of the landscape or subject while rejecting or eliminating undesirable artifacts such as unwanted reflections. However, achieving these properties, frequently requires physical rotation of optical polarizers to allow optimization of the images. For airborne UAS, the physical rotation of an optically mounted device can be challenging to design and hard to implement in practice.

Invention: Researchers at the University of Maine have developed a liquid-crystal based optical polarizer which can be controlled electrically. The technology has no moving parts and is compatible with high-quality image acquisition such as photography and videography. The polarizer technology is based on the induced orientation of the liquid crystal due to an electric field applied across a transparent sample cell. The induced orientation of the liquid crystals causes certain polarizations of light to be transmitted (preferred) and others to be absorbed (rejected). The preferred orientation can be controlled by modulating the amplitude of a sinusoidal voltage with direct current (DC) offset applied across the liquid crystal.

Advantages:

- The electro-optical polarizer technology enables preferential transmission of certain, selected polarizations of light
- Polarization selectivity is achieved by aligning the liquid crystal within the transparent cell
- The direction(s) of polarization(s) are controlled by applying varying voltages across electrodes attached to the cell
- Applying a periodic waveform enables alignment of the liquid crystal while simultaneously preventing significant buildup of ions near the electrodes
- No moving parts are required for the operation of this technology

Possible Applications: This technology would be applicable in different UAS products and platforms for a variety of applications including defense, environmental, agriculture and others.

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