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(54) Title: SYSTEM AND METHODS FOR ACHIEVING SIGNALING

(57) Abstract: The present invention is directed to an apparatus and methods for producing special effects, such as signaling. A method for signaling and other tracking methods are disclosed. The method includes the use of a particular reflective composition that reflects a particular wavelength of light. By forming compositions using the disclosed method, unique tagging and tracking methods can be achieved. The method implements the use of macro, micro, nano and pico particles that have been etched for form two and three dimensional shapes recessed in the surface of the particles. The particles are then sputtered with a reflective metallic component to enhance reflectivity. By utilizing a specific shape in the composition and a specific wavelength of light, a powder or dust can be formed which only reflects light that light at the desired specific wavelength. Utilizing these powders and compositions, advantageous methods of tracking and signaling can be achieved.

WO 2004/075624 A2

SYSTEM AND METHODS FOR ACHIEVING SIGNALING

FIELD OF THE INVENTION

The present invention relates to the field of compositions and methods by which signals may be achieved. More particularly, the present invention is directed to novel compositions that, when exposed to particular wavelengths of light, will produce a desired signal. Specific composition and methods of the present invention include particles in the macro, micro, nano and pico range that are shaped to provide specific reflectance of certain wavelengths of light while at the same time producing a form of light from oxidation.

BACKGROUND OF THE INVENTION

Bio-luminescent compositions that produce a "glow-in-the-dark" type effect are well known. For example, U.S. Patent No. 5,876,995 discloses a luminescent composition utilizes the natural biological reagent "luciferase." The enzymes and proteins associated in luciferase allow the composition to be recharged. Because luciferase is a naturally occurring biological compound, found, for example, in fireflies, squid and snails, it suffers the disadvantages of being expensive to harvest and produce. Applications for these phosphorescent compositions includes children's novelty items, watches and scuba diving gear.

Phosphorescent compositions made from biological compounds also generate heat as a result of the biological reaction which forms the phosphorescence. This limits the possible use of these compositions because among other reasons, the types of containers used to transport these compositions must be resilient to the amount of heat generated by the biological reaction. As an example, a "glow-stick" (which can use a biologically phosphorescent composition) must be packaged in a thick plastic container in order to minimize the users exposure to emitted heat. Due, in part, to the packaging, the glow-sticks do not provide color as bright or as sharp as is possible.

Furthermore, problems in visibility occur in the use of phosphorescent compositions. For example, a "yellow glowing" composition is very hard to distinguish during daylight, and tends to blend into its surrounds, because of the interfering ambient light. This is a problem that occurs when phosphorescent compositions are used for tagging and tracking methods. If a target is tagged with a composition that is not distinguishable from the ambient light, the tagging cannot be useful.

Other problems with known phosphorescent compositions used for tagging and tracking methods is that the methods required close proximity to the desired target in order to apply the phosphorescent marking or tracking composition and clearly the target would know when tagged.

Other methods of tagging and tracking include the use of a powdered composition or coating. These methods also suffer of the same disadvantages of needing proximity to the target to apply the tag and that the target knows when the tagging composition is applied.

Typically, tagging compositions are colored brightly or a specific color that is visible to the target. While visibility of the tagging composition allows the target to be identified as tagged, the target can see and remove the tagging composition.

Problems associated with known photo-luminescent compositions is that they require light as an activator and they are unavailable to use during night time since there is no light to activate the composition and moonlight is not typically strong enough to do so. This is unfortunate since many of the problems solved by luminescent compositions during the day exist at night time. For example, construction site dangers must be marked during both day time and night time. Hence, it would advantageous to develop a luminescent composition that can be activated by different types of light.

As an alternative to phosphorescent and photo-luminescent compositions, paintings and coatings have been developed to attempt to mimic the characteristics of those compositions. These attempts, however, to duplicate phosphorescent compositions suffer some of the same disadvantages as described above. For example, a paint that attempts to impart a "bright yellow" color will still have the same problems of being hard to distinguish against ambient light. Further, there are inherent problems in paintings and coatings due to differences in the application; a thin coating of paint may not be sufficient to provide the desired effect, or there may be patches of thick and thin coatings of paint that impart a different and varying effect.

Another attempted solution is to use colored particulate, such as a powder, with in a composition to provide the desired color effect. These types of compositions also suffer the disadvantage of being inconsistent in application and not as effective due to the varying layered amounts applied.

The present invention solves the aforementioned problems by providing a composition that provides for luminescence in particular ranges of wavelengths of light upon activation which do not generate a significant amount of heat, i.e., provide "cold light."

The present invention also solves the problem of the prior art requiring a visible light source to activate luminescent compositions by providing a particulate composition that is activated by varying light sources, including microwave, ultraviolet, radio frequency and infrared wavelengths of light.

The present invention provides a solution to previous tagging and tracking methods, by providing an encasement to allow a projectile, or "throwing object," to be used to tag the desired target for tracking. In addition, one embodiment of the present invention provides a reflective dust or coating that can be applied to the target without the knowledge of the target. The reflective dust or coating is responsive to certain wavelengths of light and allows the user to track the target from a long distance by applying a specific light source.

The present invention provides a solution to the above mentioned problems associated with the prior art by providing an improved apparatus and method for the tagging and tracking of objects.

SUMMARY OF THE INVENTION

In a preferred embodiment of the present invention a method is provided for the formation of a reflective dust or powder for use in signaling. The composition for signaling is formed by the steps of producing a particulate including macro, micro, nano and pico sized particles, then forming a shaped recess within said particles to form a shaped particulate and finally sputtering a reflective metallic on the surface of said shaped particulate so as to cover a portion of said shaped recess within said particles.

In another preferred embodiment, the present invention provides a reflective composition that is comprised of a particulate that includes a mixture of particles, wherein said particles include shaped recesses that are formed within one or more of said surfaces of each particle and furthermore where the particulate is sputtered with a reflective metallic component.

In yet another preferred embodiment of the present invention, a method for forming signaling composition is provided, wherein the method comprises the steps of forming a particulate, and sputtering a metallic onto said particulate to form a reflective particulate. Once the particulate composition is formed, it is deposited onto an object. A light source is then used to generate a specific wavelength of light, which is applied on said object to activate said reflective particulate.

In yet another preferred embodiment of the present invention, a spectral luminescent composition forming a controlled oxidation reaction is provided that comprises a soap and urethane mix, a reactant and a catalyst.

In yet another preferred embodiment of the present invention, method is provided for the formation of a spectral luminescent composition that forms a controlled oxidation reaction. The method comprises the steps of first, introducing a slow drying urethane compound combined with a soap solution into an unpressurized casing, then mixing a luminescent compound and a catalyst to form an oxidation burn mixture and finally adding said mixture to the casing.

In still another preferred embodiment of the present invention, a method for forming a signaling composition is provided that includes the steps of mixing a reactant with a soap and urethane mixture to form a modified reactant, then introducing the modified reactant into a chamber of a casing, where said casing has at least two chambers and where the at least two chambers are separated by a dividing member. The next step in the method is to introduce a catalyst to another of said at least two chambers in order to cause the dividing member to break and allow mixture between said modified reactant and said catalyst, forming an oxidizing composition. This causes the casing to break and deposit said oxidizing composition on the desired object. A light source is then used to generate a light that activates said oxidizing composition by directing said light onto said object.

In yet another preferred embodiment of the present invention, a method for signaling is provided by mixing a reactant with a soap and urethane mixture to form a modified reactant. The said modified reactant is introduced into a casing and placed into a container, wherein said container is preferably larger in size than the casing. The container also includes a catalyst. Action is then taken to break the casing, which allows the mixture between the modified reactant and said catalyst to form an oxidizing composition. The container is then broken on the desired object in order to deposit the oxidizing composition. A light source is then provided to generate light, which activates said oxidizing composition by directing said light onto said object.

Further advantages and applications of the present invention will become readily apparent to one skilled in the art upon a reading and understanding of the present disclosure.

DESCRIPTION OF THE INVENTION

It has also been determined that through the blending of macro, micro, nano and pico particles, specific blends of certain organic and non-organic materials in various proportions, special lighting effects - such as a "glow in the dark" effect - are achievable. The system and methods disclosed herein utilize the particular light transmittive and protective properties particles in blends and mixtures to produce such special effects, preferably for use in signaling and tracking. Specifically, compositions in accordance with the present invention provide reflectance in response to particulate wavelengths of light, and can thus provide a unique reflectance for the particular composition in use.

The reflectance provided by the presently inventive compositions are particularly applicable for wavelengths of light within the infrared through ultraviolet wavelengths of light. Specifically, it is contemplated that the compositions disclosed herein emit, what is termed for purposes of this application, a "spectral luminescence," between the wavelengths of 1800 nm to 8500 nm.

The first step in forming particulate compositions according to the present invention is to form a particulate that can include different sized particles, preferably of the range of macro, micro, nano and pico particles. For purposes of the invention, macro is considered to be as large as two millimeters.

The particle range for use in the present compositions can be achieved through, for example, powderization, fragmentation, and sphericalization. The particle range is formulated in solid spheres and flakes that resemble a fine powder, or dust, and by shaping the particles into various geometric shapes, it is possible to enhance the spectral luminescence qualities of many products, including coatings, plastics, glass, textiles, leather, ink, and vinyl. These solid spheres and flakes preferably include both purposefully shaped and irregular shapes.

The particulate compositions include both organic and non-organic pigments that are included to achieve a full spectrum of colors, and have controlled sizes of, such as those in the micron range, preferably 0-10 and 0-20 microns, as well as nano particles considerably smaller in reference to billionths of a meter within a clear coating or over a colored base coat. Also, it is contemplated that the present compositions have refractive indexes that range from 1.5 to 2.5. The refractive index aids in the ability to polish and reflect light from materials with high refractive indices, which decreases with the surface area as the wavelength of the light involved exceeds the particle size.

In certain embodiments, the particles are used for compositions according to the present invention preferably are formed on a neutral substrate including silicon wafers and natural or synthetic diamonds. It is also contemplated, however, that the substrate can be a polymer or diatomaceous earth. While other materials may be used, the substrate substances must exhibit sufficient structural strength to withstand the processes described in detail below.

These particles may then be modified to provide a shape. Certain embodiments are to provide a shaped recess formed within the surface of the particulate by means of photo-etching to form at least one angled surface that is inverted relative to the surface of the particle. Other methods of forming such shaped recesses include ion-beam etching, vapor deposition, and laser etching or ablation. Preferably, the recesses in the particulate are shaped to form what is termed a geometric construct.

Additional embodiments may include, a pyramidal shape formed in the substrate. It is contemplated, however, that a number of other two dimensional and three dimensional inverted shapes can be utilized, including conical and spherical shapes as well as others, provided that one of the interior surfaces of the etching leaves a surface that is not parallel to the surface of the particle. Compound shapes are formed by the etching methods described above from oblate and prolate spheroids, ellipsoids and/or cube corner elements.

Furthermore, conjoined shapes can be used to achieve the desired recessed shape. These conjoined shapes typically employ the use of two different types of recognizable shapes, as described above, although it is contemplated that two similar shapes can be conjoined and used in the present compositions. These conjoined shapes allow for reflectance of two different specific wavelengths of light within the same spectral luminescent composition. It is also contemplated within the present invention that more than two shapes can be conjoined to achieve reflectance in more than two ranges of light. Elements used in these blends are typically in the range from 20 to 100 microns, though some applications may require exceeding this range.

Additional embodiments include a mid-layer of uniformly etched inverted shaped optically clear prisms in the composition, so that light can be directed according to the orientation of the inverted surfaces to provide directional control of the signaling effect.

Once etched, particulate compositions, which are a blend of shaped particulate and irregular (or non-shaped) particulate, can be treated to maintain the structural integrity of the recesses that were formed. This can be accomplished, for example, by using a photoresist. A photoresist is a viscous polymer resin that may contain a chemically active polymer. Spin coating is the most common method of treating with the photoresist, although it is contemplated that other known methods of treatment could be used. The photoresist material can be irradiated in a number of ways, including using photons (photolithography), electrons (e-beam lithography) and X-rays (X-ray lithography). It is contemplated that other types of treatment may be used in accordance with the present invention, as is known to those of ordinary skill.

Once treated to maintain its internally formed shaped recess structure, the substrate is sputtered with a metallic component. Sputtering is the vaporization of surface layers from a sacrificial material, the metallic component (e.g., silver, nickel, copper, etc.), within the confines of a specialized environmental chamber where this material is then allowed to condense onto the surface of the target material, in this case the photo-etched particulate. The metallic component used is preferably any reflective metal that can be used for sputtering, including aluminum, titanium, silver, gold, copper, zinc, iron pyrites, nickel, tin or chrome. In addition, reflective minerals containing metallic properties, such as mica, could be used for sputtering.

Preferably, an alloy is also used to further facilitate reflection. Preferable alloys for use in the present invention include a combination of any of the following: nickel, copper, tungsten, lithium, nitrogen, cerium, tin, yttrium, neodymium, niobium, cobalt, lanthanum, lead, gallium, molybdenum, thorium, cesium, germanium, samarium, gadolinium, beryllium, praseodymium, selenium, arsenic, hafnium, dysprosium, uranium, boron, ytterbium, erbium, tantalum, bromine, holmium, europium, antimony, terbium, lutetium, thallium, mercury, iodine, bismuth, thulium, cadmium, silver, indium, palladium, platinum, gold, helium, rhodium, tellurium, rhenium, osmium and ruthenium.

These types of reflective metallic components and/or alloys can be used in sputtering and also in reflecting wavelengths of light to form a reflectance in the spectral luminescent region, i.e., within the infrared through ultraviolet regions. By using a particular alloy, a specific wavelength of light can be reflected.

Once the metallic has been sputtered onto the particulate, a diffraction grating is applied. The diffraction grating allows for more accurate separation and organization of the substrate and the reflective metallic component.

Through particularization, the organic and inorganic materials are able to hold color within each particle. In most cases, upon initial exposure to the specific light range designed to reflect from the particulate, such as, for example, the visible light range (which includes natural, incandescent or florescent light), the system particles provide an afterglow. The preferably saturation charge for particulate in these compositions is about eight to fifteen minutes, which allows the compositions to exhibit an afterglow that is visible to the dark-adapted eye for up to 60 minutes after initial exposure, or up to 20 hours, depending on the types of particulate and shapes used and the compositions charge is saturated. When the particulate compositions are exposed to low levels of light, such as at night time, they can release light gradually for 12 hours or more. The compositions will remain stable and can repeatedly glow for more than 10 years and is not affected by most chemicals or light, until the reactant and catalyst, as further described below, are mixed to form the spectral luminescent composition.

The particulate compositions provide an advantageous level of optics in color special effects as well as exhibiting advantageous characteristics of reflectability and adding stereoscopic dimensionality to the color and improving luminosity including white, yellow, green, warm blue, cool blue, violet, orange and red glow-in-the-dark that was not available in previous compositions. Overall advantageous characteristics include: minimum to no color fading, enhancement of the product's aesthetics, an improved and almost limitless color range, enhanced visibility, enhanced reflectivity, high reflective functionality when wet or under water, higher reflective functionality when exposed to heat and cost effectiveness. Applications for these particulate compositions that are color reflective and spectral luminescent include safety applications, signs, coatings, and also include aerosols, molds, marine, cars, swimming pools, furniture, clothing and entertainment.

The particulate compositions provide material surfaces that can collect, transmit and return ambient and direct light in a dramatic combination of scatter and retro-reflectivity that enhances total object visibility in both day and evening conditions. The particles used in the particulate are preferably sized smaller than existing organic pigment technology, which is about 8 microns. The size and shape of the particulate can determine particular characteristics. For example, a higher particle density will enhance the color, while an increase in the mechanical bonding between the resin and the particulate (due to high concentrations of irregular shaped particles) will strengthen the material.

The disclosed compositions can replace current processes including glass beads, which have long been used to enhance visibility in road markings and improve and strengthen the functionality of paints, plastics and coatings. By adding and using mixtures of particles, special color effects may be achieved which provide unique reflectance characteristics based on the specific particulate compositions used.

It has also be found that blending the particles with optically clear glass beads that are partially coated through vapor deposition or sputter deposition of a metallic or nonmetallic reflective, that these beads to magnify and re-transmit light being emitted by the reflective particulate when combined in an optically clear or generally clear carrier. In addition to glass beads, other types of optically clear materials can be used to promote reflection, including diamonds (synthetic and natural), sapphires, and polymers. For example, NASA has developed REAl Glass™ which is made from rare earth oxides, aluminum oxide and small amounts of silicon dioxide. This optical material increases and/or amplifies light. In addition ALON™ is a very durable polycrystalline aluminum oxynitride that has a high degree of transparency from the ultraviolet through the mid-infrared wavelengths. It is equivalent to sapphire in terms of optical quality, low density, high strength and high durability.

Glass particles sized greater than 100 microns are preferred for the glass beads described above. However, the specific sizing that is required for the present invention depends upon the base particulate thickness and pigment density. Heavy particulate applications suffer from colored pigment blockage of the emitted light (from the glow particulate), while a two-part system has base particulate covered by a clear top coat that contains the emitting particles and the only hindrance to emission is the refractive index of the clear coating used. Thus, it may desirable to block certain portions of the reflective surface in order to "stencil" a desired design or lettering. This is advantageous, for example, if advertising or logos are desired to be imprinted on the surface of the spectral luminescent composition.

To create spectral luminescence during low-light levels, various formulas derived from radioactive elements (elements that self transmute into another element and glow due to the energy release) and pigmented luminescent oxide particulate compositions (light excitable reradiating materials) have been added to glass surfaces or ceramics as coatings or several chemicals have been hermetically sealed within a hollow glass shape and caused to glow when mixed together (an oxidizing reaction). It is contemplated, however, that isotopes that transmute to another isotope are also included. Also, electrically conductive plastics that contain spectral luminescent pigments that luminesce when electrically stimulated are available or diodes and various other bulb types can create indirect effects (residual thermal emission), which can also be incorporated into particulate compositions according to the present invention.

Examples of electrically stimulated materials include diodes, transistors and other solid-state components which are include of regions of semiconductor (e.g., silicon, germanium). A semiconductor for use in the present invention is neither a good conductor, such as copper, nor a good insulator (dielectric), such as glass. A semiconductor in accordance with the present invention is preferably a resistor whose resistance depends on the amount of doping (impurities such as gallium or arsenic) that is within the silicon semiconductor.

The present invention uses non-radioactive solid light absorbing and emitting particles that reflect and emit various colors when exposed to low light levels after first being exposed to a suitable high lux light source. The latter have been derived from various proprietary formulas involving differences in materials which when combined cause the spectral luminescent effect (alkaline earth metal aluminate oxide europium doped being one type). Spectral luminescent particles can be rolled onto, pressed into, or sprayed onto a molten mass of glass and encapsulated by covering over with more molten glass and blown/worked into a shape or mold, blended into molten glass by hot stirring with a carbide paddle and worked into a shape or mold, or added as a glaze by mixing with powdered glass in a sacrificial binder liquid/gel (evaporates out of the mix with heat), painted onto a ceramic and fired at a high temperature, followed by a cooling period (annealing) to release heat stress and solidify the final mix. This achieves an esthetically pleasing colored effect in the crystallized/annealed final form (solidified and cooled slowly to release internal heat caused stresses) when viewed during low light levels is the aim of this initial invention.

Painting effectively with compositions according to the present invention is best accomplished by spraying, silk-screening, print-processes or brushing. The full spectrum of light is required to charge, or excite, the photoluminscent crystals, since they are designed to respond best to human visual spectral acuities, including the narrow wavelength band (400 to 700nm). The full light spectrum, high lux (light levels), greater than 100-footcandles or 1000-lux are best for the excitation of the luminescent crystals where maximum photo-saturation is achieved by approximately fifteen minutes.

The particulate compositions of the present invention also provide reflectance that can be used in paints, coatings, inks, plastics and thin film polymers when appropriate system blends and mixtures are combined with other reflectors such as glass chips, beads, mica and aluminum flakes. Although glass chips, beads, mica and aluminum flake can be used as reflectors, they can also be used as filler materials. As a filler, these types particles can be used as color enhancers, and are graded by their specific refractive index, whether they have been polished and also if any dopants or dyes have been incorporated into the particles.

Optically clear liquid carriers are produced by various paint, coatings and plastics manufacturers to which the present inventive particulate compositions are then added. These carriers (when blended) can air dry, be chemically cured, and be heat cured or light cured. Pigmented carrier systems benefit somewhat with the addition of the blend but the pigments block a large portion of the effects. As such, it is desirable that the compositions exhibit high optical clarity to facilitate light transmission.

Preferable liquid carries are clear, such as clear polyurethanes, urethanes, enamels and clear gelcoats. One example, which is not intended on being limiting, is clear polyester, which can be used in making game or sport equipment, such as bowling balls and many others that are used in thin films. It is also contemplated, however, that liquid carriers that are not perfectly clear can be used in the present invention, depending on the use of the composition. For example, pigmented (white) gelcoats can be employed depending on the application, but suffer from degradation of glow output due to pigment blockage.

The present invention provides superior performance in vital areas affecting everything from aesthetics to process control to cost. For example, certain embodiments use the particle orientation, size, blending and density to achieve a desired wetter look, which is advantageous, for example, in cosmetic applications. Two- and three-coat colors have shown an improvement for color imaging when mica, an opaque material, has been reduced in the formulation and particle mixture is integrated. In contrast, previous methods to achieve a wetter look were accomplished through the use of liquid crystals with the mid-coat region of a multiple layer coated surface and multiple layers of clear top-coat.

Pattern control, which is the ability to lay down a uniform particulate thickness, is improved using particulate compositions of the present invention due to the orientation of the spherical nature of the particulate with other pigments and reflectors such as mica and aluminum. Compositions can be enhanced by pattern control with every pass with minimum overspray providing for uniform coloration.

Other preferred embodiments of the particulate compositions of the present invention include particles that act as mini-ball-bearings on impact. The results in a strengthening for the use of particulate compositions that is similar to natural occurring materials (such as, but not limited to granite and marble) and result in greater mar, scratch and chip resistance to the surface that the composition is applied to.

Surfaces in accordance to the present invention also attain superior day time visibility and night time reflectability and also total darkness visibility through luminescence within the particle blends when treated with the presently inventive particulate compositions. Embodiments of the particulate compositions include high refractive index and spectral luminescent particles and/or metallic sputtered particles to provide renderings of full figure reflective and /or spectral luminescent objects that are visible from any angle.

The disclosed compositions can be used as a universal additive that easily formulates in all inks, paints and coatings. They are viable in water, solvent and powder-coating applications and can be sprayed or brushed on or applied as a gel coat, and works well in injected, molded and extruded processing. The particulate composition-enhanced coatings can be applied to metal, asphalt, wood, wood substitutes, paper, plastic roller-coated and screen printable liquid plastisol substrates.

The spherical nature of some elements incorporated in particulate compositions according to the present invention also assist the in fluid circulation versus the angular geometry of many fillers and additives that it replaces. The spherical nature of the particulate avoid clumping and other problems that are associated with random shapes within the particulate composition.

In many cases, the disclosed compositions can replace more expensive pigments and reflective compositions, while achieving the effect provided by the replaced product in two coats that other additives achieve in several coats.

Particulate compositions in accordance to the present invention also exhibit a more durable finished coating through mechanical bonding within the target material, thus reinforcing the composition and allowing it to last longer.

EXAMPLE 1

To date, luminescence has not been used in a capacity much beyond basic personnel tagging in non-warfare situations. These prior luminescent compounds typically phosphoresce as a result of a biological-chemical reaction. In contrast to prior art methods using a natural biological reagent which are capable of being recharged, the present invention utilizes non-biological man-made synthesized chemical compounds that provide spectral luminance and react until they have been completely oxidized and are incapable of being recharged.

Spectral luminescent compositions in accordance with the present invention produce a visible composition that is a two-part solution, one part being a reactant and an encapsulant and the second part being a catalyst. The two-part solution is encapsulated in a tube that can be attached to personnel in training during low level illumination maneuvers. Flexation of the tube causes activation of the composition (preferably by rupturing an internally contained ampoule) whereby the mixing of the first part of the solution and the catalyst begin a chemical oxidation burn, which luminesces and releases light.

The disclosed compositions provide a long lasting peroxide based spectral luminescent composition that can be partially encapsulated by a viscous mixture of urethane and soap to provide, in a preferred embodiment, a non-visible aerosol type spray marking capability. In another preferred embodiment, a fragmentable throwing object could be created for use in tagging a moving object or mark a dangerous area for view by an aircraft. In yet another preferred embodiment, a viewable composition could be manufactured for marking dangerous areas within a construction (or mining) area or site during night time periods.

In forming compositions for spectral luminescence in accordance with the present invention, a slow drying urethane compound is combined with a soap solution. Preferable urethane compound that can be used include polyesters and polyethylenes. Any urethane can be used, provided that the urethane exhibits chemical resistance and tensile strength that allow miscibility with the soap solution.

The soap solution is added to the urethane compound in order to minimize exposure of the urethane to the reactant and catalyst. This allows the oxidation reaction that takes place with the reactant, catalyst and urethane to be minimized and therefore allows the release of light to occur over a longer period of time. Preferable soap solutions include any type of household dish soap, for example, and include other types of soap solutions. Importantly, any soap solution employed in compositions in accordance with the present invention, must include the ability to coat and allow the urethane to slowly react with the reactant and catalyst to promote the generation of light at a steady-state that is slower than previous luminescent applications. Thus, it is also contemplated that other solutions may be added to the urethane compound to slow down oxidation, other solutions that may be used include encapsulants that allow for a slow release of the reactant.

Reactants according to the present invention include, among others, dibutyl phthalate, CPPO luminescer (bis(2,4,5-trichloro-6-carbopentoxphenyl)oxalate), CBPEA fluorescer (l-chloro-9,10-bis(phenylethynyl)anthracene), boric oxide and/or other oxides of boron including sodium borohydrate.

An activator or catalyst is also employed in the presently inventive compositions. Such catalyst is preferably a peroxide. For example, preferred catalyst for the present invention include, among others, hydrogen peroxide, dimethyl phthalate, t-butyl alcohol and sodium salicylate.

In one preferred embodiment, a peroxide based material (the reactant) is partially encapsulated by a viscous mixture of urethane and soap to provide a non-visible aerosol type spray having marking capability. The encapsulation of the reactant controls the rate of the reaction, the higher the concentration of the soap and urethane component of the composition, the slower the reaction. As explained above, the preferable compound for the catalyst is a hydrogen peroxide and the preferable compound for the reactant includes a dimethyl phthalate component and a dye pigment.

In this embodiment, the two-part solution (reactant and soap and urethane with the second part being the catalyst) is encapsulated within a casing, preferably glass or a low-density polyethylene (LDPE), that is attachable to persons or objects in low illumination maneuvers. Activation of the spectral luminescence is achieved through flexation of the casing, which causes a rupture of an internally contained ampoule whereby the mixing of modified reactant and catalyst begin a chemical oxidation burn, releasing light.

While the casing is preferably glass or LDPE, it is contemplated within the present invention that the casing could be any material with high opacity and/or optical clarity, while being resistant to the individual chemicals and the final combined reagents. Furthermore, consideration must be taken when choosing a casing material, as osmosis will occur should these materials be too thin, thus spoiling the mixtures and their shelf life. Most importantly, the materials must remain in liquid form and separate until the time of use within their own hermetically sealed casings.

The spectral luminescent composition is formed by first introducing a slow drying urethane combined with a soap solution into an unpressurized container, for example a spray-canister, along with a small metal ball-bearing to assist in mixing the composition. The spray canister is preferably a "Jennican"-type due the ability to be pressurized with almost any type of propellant through a side mounted valve, such as a Schrader-type valve. However, it is contemplated that other types of containers could be employed, and the invention is not limited simply to spray canisters. A carbon dioxide, Argon or other type of noble gas, can be used in the manufacture of the aerosol composition due to its unreactive nature.

The reactant and a dye pigment are then mixed with a peroxide catalyst. One source of peroxide catalyst is provided by Northern Products Co. of Leominster, MA. However, it is contemplated that other peroxides may also be employed to achieve the desired results of the present invention. Preferable peroxides include hydrogen peroxide, dimethyl phthalate, t-butyl alcohol, sodium salicylate. The resultant mixture of the reactant and catalyst will luminesce for a period that is dependent on the catalyst. As this is an oxidizing reaction, containment or encapsulation is required. The combination of the soap and urethane component in conjunction with a pressurized and substantially air-free container provide the containment or encapsulation necessary. The mixture is then added to the container and then agitated to ensure substantially mixture of all three of the components of the composition.

Various spray-tips, as are well known in the art, may be employed to achieve the dispersal of the composition, with a uniform dispersal being the most preferred dispersal method. The final aerosol composition can be applied to numerous different surfaces, including fabrics, sand, ceramics, and metal surfaces; however, it is contemplated that the composition may include different additives, surfactants and adhesives for a particular desired surface to be treated with the aerosol. For example, such an aerosol could be employed for tagging and tracking. In addition, a viewable version could be used for marking dangerous areas within a mining operation or on a construction site to mark a dangerous area during night time periods.

EXAMPLE 2

In another preferred embodiment of the present invention, the container discussed in Example 1 is not a spray-canister. Rather, the container for the spectral luminescent composition can be a substantially air-free, substantially chemical resistant (or at least a lining thereto), resilient, ergonomic throwing shape sized and structured to burst upon impact. One example is a plastic encasement, similar to that of a pellet of ammunition for a paintball gun. Upon impact, the plastic encasement breaks apart, depositing the composition onto the targeted object, and allowing for the oxidation reaction between the catalyst and the reactant to occur. The oxidation reaction will create spectral luminescence until all the catalyst is used up.

The fragmentable container that is used for this embodiment could be employed, for example, for tagging and tracking a moving vehicle or a dangerous area for view by aircraft.

EXAMPLE 3

Example 3 is similar to Example 2 and represents another preferred embodiment of the invention. In this embodiment, the container is again a substantially chemical resistant (or at least a lining thereto), resilient, ergonomic throwing shape that is capable of bursting upon impact. However, in this embodiment, the container is multi-chambered, having at least two chambers that are separated by a dividing member, which can be a thin plastic membrane. Two chambers are required in order to keep the catalyst separate from the reactant. It is contemplated that a third chamber could be used for the soap and urethane mixture. It is further contemplated that a fourth chamber could be implemented for other additives, such as adhesives and/or surfactants.

The container is preferably a different material than the dividing member. Preferably, the dividing member has a much lower threshold for breakage than the container. In operation, the user may shake the container to allow the dividing members to break, thus allowing mixture between the individual chambers. After mixing, the composition will oxidize at a rate that is proportional to the amount of catalyst versus the amount of the soap and urethane mixture. Since the soap and urethane mixture will act to encapsulate the reactant, the more of the soap and urethane mixture and the less of the catalyst will result in the slower the oxidation reaction. Once mixed, the composition within the container is ready to be deposited on the desired object for tagging and tracking by exhibiting the desired spectral luminescence.

It is contemplated that the composition can be deposited onto the desired object in the form of a hand-thrown container, for example, a "grenade" type structure. It is also contemplated that the container for the spectral luminescent composition can be used in conjunction with a firing apparatus, such as a gun or some other launching apparatus. Of course, in using an automatically firing apparatus, the container of the composition must be resilient enough to withstand the firing of the apparatus with out bursting within the apparatus.

EXAMPLE 4

In another preferred embodiment of the present invention, the compositions described in Examples 1-3 include reflective particulate as described above that incorporate the use of certain recessed shapes that are suited for the reflectance of specific wavelengths of light. The reflective particulate is mixed with the composition or, as described in Example 3, can be separated from the reactant and catalyst in a separate chamber within the container. Alternatively, the reflective particulate can be mixed with either the reactant or the catalyst or both. However, there should be no chemical reaction involving the reflective particulate.

The reflective composition is formed from a particulate that is made up of macro, micro, nano, and pico sized particulate. To form the particulate, silicon wafers are photo-etched using a masking process in several stages to attain a final shape. The particulate is then treated with a photoresist, in order to maintain the structural integrity of the shaped recesses formed within the particles.

Several runs of masking are required if using multiple shapes. First one run of the masking process will be used to photo-etch a specific shape, such as an inverted pyramidal shape. Masking runs will follow in order to refine the recessed shapes within the particulate. Next, if desired, more shapes can be photo-etched into the silicon particles. For example, it may be desirable to photo-etch conical shapes into the particle to achieve a desired reflectance. This can be accomplished by using a similar masking process, followed by several refining masking runs to make another shape in the particulate. If desired, further runs for other shapes, such as concial, can also be photo-etched into the particulate in order to achieve the desired reflectance; followed by masking runs in order to refine the shapes that are being photo-etched into the particulate. Furthermore, it is contemplated that conjoined shapes could be etched into particles, providing more than one shape for reflectance.

A Karl Suss MA6 Contact Aligner maybe used for exposing and inspection of the particulate. It is also possible to use other micro-fabrication equipment for the exposure and inspection of the particulate. A JEOL JSM-6500F Thermal FE SEM is then used to further define the selected shapes through an onboard electron beam lithography system.

Once the desired shapes have been photo-etched into the particulate, magnetron sputtering of a metallic reflective component is applied onto the particulate, and more specifically, into the surface of the walls of the recesses of shapes formed within the particulate. The sputtering provides additional reflectivity in the composition. The surface of the particulate is built using this sputtering process layer by layer on the particulate until the desired properties are achieved. It is contemplated that a base metal may be sputtered, followed by one or more alloys in order to provide a unique reflectance of wavelengths.

Furthermore, diffraction grating is applied to the micro particulate composition in order to cause alteration of the incoming light as it is reflected. Diffraction grating is achieved by scribing fine parallel lines with equal spacing on semi-clear plastic films.

EXAMPLE 5

In yet another preferred embodiment of the present invention, the disclosed compositions can be used in recreational activity and game applications. For example, the presently inventive compositions can be used in bowling balls. The outer shells or bowling balls are comprised of , for example, various materials such as polyester based shells for lower-end, less expensive bowling balls, and urethane for the higher-end, more expensive bowling balls. The disclosed compositions can be added to the exterior plastic material (e.g., polyester, urethane, etc.) to form a composite material. Before it is catalyzed, and after which the composite material is poured into individual ball molds, the composite material is allowed to solidify, and then finally rounded and polished into the finished product. Furthermore, laser and/or mechanical tools can be used to cut or etch a logo or writings into the surface of the ball, which can then be filled by an epoxy or other material that contains a higher concentration of the particulate composition according to the present invention.

EXAMPLE 6

In another preferred embodiment of the present invention, reflectivity methods and compositions as described above are used for signaling. This signaling can take the form of providing a target reflecting a specific wavelength of light. Only by knowing this specific wavelength of light that the composition is designed for is it possible to retrieve information, such as location, of the target.

Preferable compositions include a base metal for the reflective metallic component, such as aluminum, gold, copper or tin. In addition to the base metal, a specific alloy is used to provide a unique reflectance transmission that is identifiable to whoever placed the particulate composition on the target. Preferably, compositions in accordance to this embodiment are comprised of at least 40% metal, where the remaining fraction of the composition may be non-metallic.

It is contemplated that such compositions could be used in radar reflectivity, such to identify persons or objects that have entered or are present within a certain area. Since compositions in accordance with the present invention may be in powder form, the target may be unknowingly reflecting the particular wavelength of light. It is contemplated that by use of these compositions, one or more persons entering a restricted area may be identified, by for example, placing a supply of the composition over an entrance, where a certain amount of the powder is released every time a person enters through the entrance.

It is also contemplated that such powder compositions, which appear to be a dust, could also be used for radar reflectivity. For example, an aircraft identifying a suspicious area could release a certain amount of the powder onto a specific location for later identification by another aircraft knowing which particular wavelength of light is being transmitted by the composition. Similarly, a pilot whose plane was downed may assist in his or her recover by marking the area in which the pilot dropped this material.

EXAMPLE 7

It is also contemplated that compositions in accordance with the present invention provides radar reflection of a particular wavelength of light by the etched shaped within the particulate and also provides "retro-reflection" through the substrate. Compositions in accordance with this specific embodiment of the invention preferably use diamond or sapphire as an optically clear substrate, however, it is contemplated that substrates that are not perfectly transparent could also be used.

EXAMPLE 8

In another preferred embodiment, the disclosed compositions can be formed on a reactive foundation, such as sodium. These compositions are typically formed within an inert gas environment, such as a noble gas. For example, a sodium substrate can be sputtered with an aluminum reflective metallic component and then the composition formed is encapsulated within a glass sphere.

These compositions still provide the same reflectivity properties as previous preferred embodiments, however, during reflection, either of the reflective metal or the substrate (depending on the combination chosen) will oxidize, thereby degrading the reflectance of the composition at a high rate. These types of compositions are used, for example, to provide a time period for reflection of the composition; i.e., to avoid the composition reflecting in perpetuity.

It is also contemplated that the composition in accordance with this preferred embodiment of the invention could be used in signaling applications, for example, as described in Example 6, but to identify a target for a much more limited time period.

EXAMPLE 9

In yet another preferred embodiment of the present invention, compositions are formed as described above with a reactive substrate/metallic component combination. However, as opposed to Example 8, where the substrate or metallic component degrades, this embodiment provides for degradation of the encapsulant. Encapsulants that are preferred for the present compositions include wax, glass or polymers (such as membranes) that retard degradation for a specific time period. These types of compositions will degrade the encapsulant, thereby resulting in a shortening of compositions described, for example, in Example 4.

EXAMPLE 10

In another preferred embodiment, the disclosed compositions can be applied on/in watercraft hulls, decks and other uses where luminescent properties would add safety and design benefits to watercraft. This technology provides significant advantages over existing luminescent materials that might be used to create similar effects. Specifically, the current compositions provide significantly longer "lighting" duration in that, for example, fifteen minutes of exposure (or such other timing equivalent to the saturation charge) to the proper lighting will result in at least 12 hours of phosphorescent emission. Furthermore, compositions according to the present invention provide the ability to embed in, or apply on, finished boat surfaces and have stability at dramatically higher temperatures (up to 2400 degrees Fahrenheit). Additionally, a wide range of colors can be used for the present compositions and the daylight color (e.g., white) is different from the nighttime color (e.g., yellow, blue, orange or combinations thereof). Furthermore, compositions in accordance with the present invention utilize this type of augment to increase the visibility of the finished product for both safety reasons and to provide additional esthetic value due to the inherent uniqueness of the particulate composition "glow" effect.

Measurements have been made of the luminescence decay characteristics of strontium aluminate particle samples supplied by GCI. These measurements were carried out according to the DIN 67510 standard specification for longtime afterglowing luminescent pigments, except that the luminance of the front surface (i.e., the surface that was irradiated) was monitored, not the hack surface.

A 150 Watt xenon lamp in a housing with a condenser and collimating optics was used to produce a uniform field of illumination of 1000 LUX at a distance of 2.4 meters from the source. The luminance measurements were made with a Hagner ECI Digital Luxmeter.

Samples were mounted with their front faces vertical and illuminated at normal incidence. The samples were first stored under subdued lighting conditions for a period of 20 minutes to allow residual luminescence to decay, after which they were exposed to the xenon light for 5 minutes. Since the limit of sensitivity of the Hagner Luxmeter was 0.1 lux, a United Detector Technology (UDT) silicon photodiode detector with a circular sensitive area of 1.00 cm sq. was used for low light measurements. The detector was calibrated against the luxmeter in the luminescent decay spectrum of the samples at times shortly before the exposure.

To make the luminance measurements, the luxmeter was placed flush against the surfaces of the 50 mm diameter samples. The samples filled the hemispherical solid angle of reception of the detector. Assuming the samples radiate with uniform luminance, as a Lambert source, the luminance M (in lux, or lumen/m sq.) is related to the luminance L (in candela/m^2). In this embodiment, the values quoted are the luxmeter readings in units of millilux (mlx = 10^{-3} lux).

The photocurrent generated by the photodiode was amplified through a transconductance stage, whose output was monitored with a digital voltammeter. Tests were performed in a temperature-controlled environment with a temperature in the range of 22°C, +/- 3°C.

Figure 1 reproduced below shows the measured luminescence of the three samples at various times after exposure to irradiation on a logarithmic scale in both axes. The samples show almost identical characteristics. The average luminescence at selected times is shown in Table 1 below.

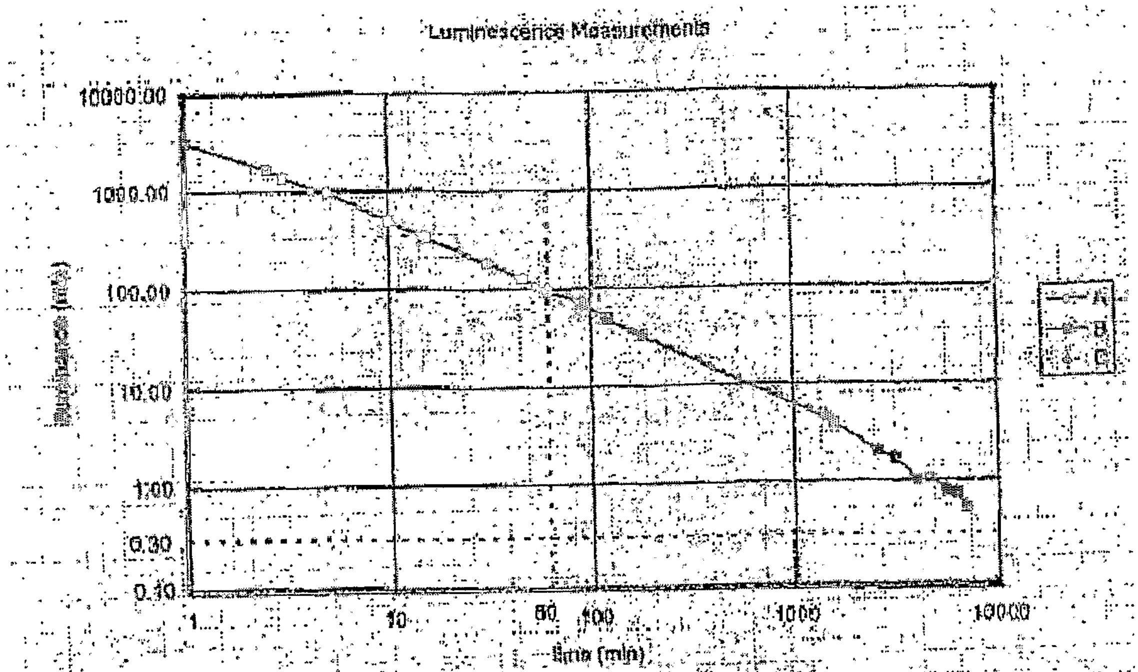

Figure 1: Log-log plot of luminescence decay of three samples A, B, C. The time is measured from the instant at which the excitation is switched off.

Time (min)	1	2	5	10	60	120	180
Illuminance (mlx)	3200	1950	930	490	92	47	32

Table 1: Average luminance of three samples at selected times

From an initial luminance of approximately 8000 mlx, the luminescence decays over a long period of time. The last measurement, at 7000 minutes, gave an average reading of 0.55 mlx. Extrapolating the graph, it is estimated that a level of 0.3 mlx would be reached only after about 9000 minutes. Because of the very slow decay, it is difficult to specify this time with precision better than about 500 minutes.

The color of luminescence at one minute after the excitation was removed was yellow-green, which, at the time of testing, was the brightest of all of the available colors. This is due the relationship between time and color; the brighter the illumination source the faster the photon uptake, and therefore, excitation of the glow particles.

Measurements were carried out according to the DIN 675 to standard specification for longtime afterglowing luminescent pigments on three samples of strontium aluminates pigment, with the exception that the luminance of the irradiated surface of the sample was measured, rather than the rear of the surface. After 60 minutes, the average luminance decayed to 92 millilux. A level of 0.3 millilux would be reached only after about 9000 minutes.

EXAMPLE 11

One example of a practical application would be the use of the particulate composition in conjunction with a plastic or metal STOP sign. This could be achieved by first painting the sign with a red pigmented paint, then stenciling in the STOP lettering with white paint. The sign could then be repainted in the red pigmented area with a "glow-in-the-dark" red particulate composition in accordance with the present invention that has been mixed by proportion in an optically clear carrier. When dried the STOP lettering can be repainted with a "glow-in-the-dark" warm blue particulate composition according to the present invention that includes a reflective particle blend that has been mixed by proportion in an optically clear carrier. Two or more passes may be required in order to get sufficient material build-up. The last step in the process would be to clear coat the entire sign with a UV blocking clear topcoat to protect it from environmental deterioration.

EXAMPLE 12

A second example of uses of the present inventive particulate compositions would be for a luminescent, reflective road line, which would require approximately two pounds of blended material per gallon of paint and a variance in the glass particle size (typically a larger size) to protect the composition from impact wear from vehicular traffic (particle sizes are usually very similar in a blend). Previous experiments have shown that this can be a single application (add blend to the pigmented carrier) or two-step application process (coat over pigmented basecoat with UV stabilized clear carrier topcoat to which the appropriate blend has been added), with the latter having the best results.

Economical smooth surfaces are accomplished by utilizing smaller particles and with minimal coats of resin. Where a textured surface is desired, the particle size can be varied. Such texture would be applicable, for example, in the case of a highway road-line. In such an application, smaller particles provide only color, while more durable particle elements (such as beryllium glass beads) larger than 100 microns are desirable to protect the less durable resin/particles of the overall composition, which will allow the highway road-line to last months or even years longer than current road-lines. Etching of shapes in the particulate is also applicable to highway road-lines, since the etched shapes can be used for the purpose of directing light along a specific path and also used to polarize (gratings) or magnify light (Fresnel lens).

EXAMPLE 13

The inventive compositions and particulate mixtures are also applicable to other applications, such as formation of holographic images. Use of diffraction grating and iridescence applications, in accordance to the present invention can be achieved by using commonly known methods, such as described in U.S. Patent Nos. 5,064,264, 5,202,013, 6,650,477, which are hereby incorporated by reference. Holographic images according to the present invention can also be achieved by using commonly known methods of production, such as described in U.S. Patent No. 6,674,554, and 6,692,666, which are hereby incorporated by reference.

The compositions of the present invention can be used, for example, to create holographic images and iridescence. Furthermore, depth of view can be attained by proprietary blending of particles can be attained by blending the particulate and the irregular particle shapes which increases durability of the composition when applied. Special effects according to the present invention provide longer lasting surfaces and richer colors on marine, automotive, aerospace and other products

The only colored holographic images available are generated by computerized laser systems or by cathode ray tube on a particle screen, film, and liquid or gas background or through projection methods on solid surfaces requiring special glasses for viewing.

One solution to the coloration of holograms within solids includes the combination of optically clear glass (which allows laser penetration) or crystal and optically clear plastic, gel, or other resin with closely matching refractive indexes. A YAG laser or other high energy source is used singularly or in combination and then focused at varying depths within the combined materials to produce various colors where none were observed previously. The optically clear glass or crystal will produce its normal white coloration while the optically clear plastic, gel, or other resin will produce various colors. Manipulation of the plastic, gel, resin or combinations of the latter by the manufacturer/formulator at the molecular level (creating a precisely doped plastic) will allow the artisan to tailor the effects and colors desired to the requirements of the user/purchaser. Since the plastic is a specialty third party formulation it will have various chemistries and densities in order to target specific colors, as such it is important to pretest a sample prior to encapsulation with glass.

Another solution to the coloration of holograms or other decorative designs within solids consists of trapping dopants within seeds of soda-lime glass, boro-silicate glass, Pyrex, quarts, plastic, resin, gel, other glass/crystal or combinations of the latter that closely match the refractive index of the specified target solid and then are added during manufacture of that same target solid. These doped crystals (containing oxides of copper, iron, etc) are mixed into an optically clear plastic in very small amounts (less than 0.5%) so as to be almost unseen. The computer program controlling the laser and an optical sensor (for spotting the seeds) are required for precise targeting of the seeds within the plastic. Doped crystals melt at a higher temperature than the glass plastic or crystal they are dispersed in, and therefore, to allow for manipulation by high-energy laser or other high-energy source or in combinations of the latter, energy from the laser is focused to a point within the seed which eventually causes the seed to melt. The crystalline mixture is then stirred by moving the energy source, which then allows elements within the mixture to combine. The mixture is then allowed to solidify; which creates the multi-colored effect.

EXAMPLE 14

Various combinations of the latter mentioned methods will come in to play in making an item such as a multi-stage lens. It is contemplated for the present invention that any lens that accomplishes the applications of for telecommunications, two-dimensional and three-dimensional viewing systems and optical security systems could be used in the present invention. For example, by focusing the laser at varying depths within an optically clear doped plastic (melt stirring) which is contained within an optically clear but refractive index matching glass crystal, a colored light filter (yellow, brown, etc.) can be assembled. By focusing the laser at varying depths within the glass crystal, a Fresnel Lens can be created (etched) in front of the colored lens, resulting in a magnifying, filtering lens combination. The Fresnel lens is used to magnify, and is created by etching or cutting very thin lines in decreasing concentric circles within, or on, an optically clear substrate.

Examples of practical application of the aforementioned uses include glow-in-the-dark glass, beer mugs, bottles, drinking glasses, art crafts, glass murals, chalices, pottery, security, glass gifts, glass art, windows, awards and other items to be displayed during low-level lighting. Examples of products that could be derived from the aforementioned embodiments of the present inventive particulate compositions include: artworks, optical switches, waveguides, lenses, filters, gratings and security oriented items (e.g., keys, identification badges and/or tags).

Until recently, laser created artwork within optically clear glass crystal has only been available in a single color offering (white). Efforts to produce multiple colors by way of dopants within the glass matrix would not allow for color without sacrificing the clarity of the glass. Other types of glass artworks have beads or strips of colored oxides or dopants (titanium, copper, etc.) in many vivid colors, which after being stretched along with other manipulations, are then encapsulated by a covering of clear glass in a set pattern. The presently inventive particulate compositions allow for multi-colored artwork by modifying the transmittance of light through the artwork. The addition of particulate according to the present invention allows transmittance of desired colors at particular wavelengths of light.

The invention has been described with reference to the preferred embodiments. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

CLAIMS

1. A method for the formation of a reflective dust, the method comprising:

producing a particulate including macro, micro, nano and pico sized particles;

forming a shaped recess within said particles to form a shaped particulate;

sputtering a reflective metallic on the surface of said shaped particulate so as to cover a portion of said shaped recess within said particles

wherein said reflective dust exhibits spectral luminescence.

2. The method of claim 1, wherein said particulate is formed on a silicon substrate.

3. The method of claim 1, wherein said particulate is formed on a polymer substrate.

4. The method of claim 1, wherein said particulate is formed on a diatomaceous earth substrate.

5. The method of claim 1, wherein said shaped recess is pyramidal.

6. The method of claim 1, wherein said shaped recess is conical.

7. The method of claim 1, wherein said shaped particulate is a mixture of shapes.

8. The method of claim 7, wherein said mixture of shapes includes pyramidal and conical.

9. The method of claim 1, wherein said shaped recess is formed by photo-etching.

10. The method of claim 1, wherein said shaped recess is formed by ion-beam etching.

11. The method of claim 1, wherein said shape and recess are grown by vapor deposition.

12. The method of claim 1, wherein said shaped recess is formed by laser ablation.

13. The method of claim 1, wherein said reflective metallic is selected from one or more from the group consisting of: aluminum, titanium, silver, gold, copper, zinc, iron pyrites, and nickel.

14. The method of claim 1, wherein said shaped particulate is produced from oblate/prolate spheroids, ellipsoids, or cube corner elements.

15. The method of claim 1, wherein said shaped particulate is produced from a geometric construct.

16. A reflective powder comprising:

a particulate including a mixture of macro, micro, nano and pico sized particles, each particle having at least two surfaces;

wherein said particles include shaped recesses that are formed within one or more of said surfaces of each particle to form a shaped particulate;

wherein said particulate is sputtered with a reflective metallic; and

wherein said reflective powder exhibits spectral luminescence.

17. The powder of claim 16 wherein said powder reflects microwave wavelengths.

18. The powder of claim 16 wherein said powder reflects radio frequency wavelengths.

19. The powder of claim 18 wherein said powder also reflects microwave wavelengths.

20. The powder of claim 16 wherein said particulate is formed on silicon substrate.

21. The powder of claim 16 wherein said shaped recesses are formed in said particulate by photo-etching.

22. The powder of claim 16 wherein said shaped recesses are formed in said particulate by ion-beam etching.

23. The powder of claim 16 wherein said shape and recess are grown in said particulate by vapor deposition.

24. The powder of claim 16 wherein said shaped recesses are formed in said particulate by laser ablation.

25. The powder of claim 16 wherein said reflective metallic is one of the group consisting of aluminum, titanium, silver, gold, copper, zinc and nickel.

26. The powder of claim 16 wherein said reflective metallic is a mixture of at least two of the group consisting of aluminum, titanium, silver, gold, copper, zinc and nickel.

27. The powder of claim 16 wherein said reflective metallic may be alloyed with one or more elements, selected from Ni, Cu, W, Li, N, Ce, Sn, Y, Nd, Nb, Co, La, Pb, Ga, Mo, Th, Cs, Ge, Sm, Gd, Be, Pr, Se, As, Hf, Dy, U, B, Yb, Er, Ta, Br, Ho, Eu, Sb, Tb, Lu, Tl, Hg, I, Bi, Tm, Cd, Ag, In, Se, Pd, Pt, Au, He, Te, Rh, Re, Os, Ru.

28. The powder of claim 16 wherein said shaped particulate is produced from oblate/prolate spheroids, ellipsoids, or cube corner elements.

29. The powder of claim 16 wherein said shaped particulate is produced from two or more conjoined shapes.

30. A method for signaling, comprising:

forming a composition;

sputtering a metallic onto said composition to form a reflective composition;

depositing said reflective composition onto an object;

generating light from a light source;

applying a light source on said object to activate said reflective composition.

31. The method of claim 30, wherein said composition includes an encapsulant.

32. The method of claim 30, wherein said composition includes a photon emitting particle compounded from the following elements or similar: (SrO)·(MgO) 0.1·Al_2O_3 (EuO,Dy_2O_3) 0.001B or Al_2O_3, SrO, Eu_2O_3, Dy_2O_3 or MO.Al_2O_3:Eu.

33. The method of claim 30 wherein said reflective composition is formed from a mixture of macro, micro, nano and pico particles.

34. The method of claim 33 wherein said particles are shaped to form a shaped particulate.

35. The method of claim 34 wherein said particles are photo-etched to form a shaped recess within each particle.

36. The method of claim 34 wherein said particles ion-beam etched to form a shaped recess within each particle.

37. The method of claim 34 wherein said particles are grown by vapor deposition to form a shaped recess that is within each particle.

38. The method of claim 34 wherein said particles laser ablated to form a shaped recess within each particle.

39. The method of claim 35 wherein said shaped recess is pyramidal.

40. The method of claim 30 wherein said metallic is one of the group consisting of aluminum, titanium, silver, gold, copper, zinc and nickel.

41. The method of claim 30 wherein said metallic is a mixture of at least two of the group consisting of aluminum, titanium, silver, gold, copper, zinc and nickel.

42. The composition of claim 30 wherein said reflective metallic is an alloy including one or more elements selected from: Ni, Cu, W, Li, N, Ce, Sn, Y, Nd, Nb, Co, La, Pb, Ga, Mo, Th, Cs, Ge, Sm, Gd, Be, Pr, Se, As, Hf, Dy, U, B, Yb, Er, Ta, Br, Ho, Eu, Sb, Tb, Lu, Tl, Hg, I, Bi, Tm, Cd, Ag, In, Se, Pd, Pt, Au, He, Te, Rh, Re, Os, Ru.

43. The method of claim 30 wherein said light source has a wavelength in the microwave region.

44. The method of claim 30 wherein said light source has a wavelength in the radio frequency region.

45. The method of claim 34 wherein said shaped particulate is produced from oblate/prolate spheroids, ellipsoids, or cube corner elements.

46. The method of claim 34 wherein said shaped particulate is produced from a geometric construct of two or more conjoined shapes.

47. A spectral luminescent composition forming an oxidation burn comprising:

a soap and urethane mix;

a reactant; and

a catalyst.

48. The composition of claim 47 wherein said soap is a household detergent.

49. The composition of claim 48 wherein said reactant is a spectral luminescent compound is one of dibutyl phthalate, CPPO luminescer (bis(2,4,5-trichloro-6-carbopentoxphenyl)oxalate), CBPEA fluorescer (1-chloro-9-10-bis(phenylethynyl)anthracene), boric oxide or derivatives of boron including sodium borohydrate.

50. The composition of claim 49 wherein said catalyst is one of hydrogen peroxide, dimethyl phthalate, t-butyl alcohol, sodium salicylate.

51. The composition of claim 50 wherein the percentage of said soap is directly proportional to the desired length of said oxidation burn.

52. A method for the formation of a spectral luminescent composition forming an oxidation burn comprising the steps of:

introducing a slow drying urethane compound combined with a soap solution into an unpressurized casing;

mixing a luminescent compound and a catalyst forming an oxidation burn mixture;

adding said mixture to said casing.

53. The method of claim 52 wherein said casing is a Jennican spray-can having a spray-tip.

54. The method of claim 52 wherein said casing is pressurized with a noble gas.

55. The method of claim 52 wherein said casing is a low-density polyethylene.

56. A method for signaling comprising the steps of:

mixing a reactant with a soap and urethane mixture to form a modified reactant;

introducing said modified reactant into a chamber of a casing, wherein said casing has at least two chambers, wherein said at least two chambers are separated by a dividing member;

introducing a catalyst to another of said at least two chambers;

causing said dividing member to break and allow mixture between said modified reactant and said catalyst, forming an oxidizing composition;

causing said casing to break and deposit said oxidizing composition on said object;

generating light from a light source; and

activating said oxidizing composition by directing said light onto said object;

wherein said oxidizing composition reflects a defined wavelength of light.

57. A method for signaling, the method comprising the steps of:

mixing a reactant with a soap and urethane mixture to form a modified reactant;

introducing said modified reactant into a casing;

placing said casing into a container, wherein said container is larger in size than said casing and includes a catalyst;

causing said casing to break and allow mixture between said modified reactant and said catalyst, forming an oxidizing composition;

causing said container to break and deposit said oxidizing composition on said object;

generating light from a light source; and

activating said oxidizing composition by directing said light onto said object

wherein said oxidizing composition reflects a defined wavelength of light.