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(54) **Gloves with a visual indicator to remind change**

(57) Thin wall gloves have color change time indicators. A color change label or friendly reminding message can be seen after the glove is put on for a period of time. The warning indicators can be triggered via UV, visible light, temperature change, air exposure, presence of oxidizers (oxygen, chlorine), pH change, chemical reaction of two components or any combination of these activators. The method for producing these gloves can be easily realized under common glove production lines. Depending on the desired applications, both powdered and powder free gloves can be produced.

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Description

Background of the Invention

[0001] Single use disposable gloves have been widely used in many fields and industries to provide necessary hand protection and to avoid cross contamination. It is a common practice to frequently change gloves, because thin wall gloves may fail after a prolong period of time, or cross contamination may be induced with more than one substance or object being handled.

[0002] It is desirable to have some kind of warning indicator to provide better protection. There are a number of mechanisms and methods that have been produced.

[0003] For example, a glove with multiple layers can be made with a colored liquid in between the layers, as shown in U.S. Patent 6,370,694. Once the glove is punctured half way through, the colored liquid will flow out and be seen. Another example is a glove with multiple layers with a vacuum in between. Once the glove is punctured halfway through, the glove becomes inflated. These inventions provide better protection against glove failures caused by punctures.

[0004] U.S. Patent No. 6,744,368 describes another breach detecting glove. Again, a liquid is sealed in between multiple layers, and a microchip is embedded into gloves. Once the glove fails, the sealed in liquid will activate the microchip which, in turn, will communicate the compromised integrity of the glove to the wearer.

[0005] All these methods deal with a glove damaged by punctures. They all assume that the puncture occurs half way through the glove, so that the wearer can be protected by a prompt glove change. Obviously, that is not always the case, not to mention when the liquid flowing out causes contamination.

[0006] It would be desirable to have an indicator that can remind the wearers to change gloves before the glove barrier integrity is compromised.

[0007] It is an object of the invention to provide a time sensitive indicator on a glove.

[0008] It is another object of the invention changing color with time to signal the need to change gloves.

[0009] It is still another object of the invention to provide a glove with a visual indication of the amount of time a glove has been worn.

[0010] It is yet another object of the invention to provide length of time indicators triggered by any number of activators.

Summary of the Invention

[0011] Thin wall gloves have color change time indicators. A color change label or friendly reminding message can be seen after the glove is put on for a period of time. The warning indicators can be triggered via UV, visible light, temperature change, air exposure, presence of oxidizers (oxygen, chlorine), pH change, chemical reaction of two components or any combination of these activators. The method for producing these gloves can be easily realized under common glove production lines. Depending on the desired applications, both powdered and powder free gloves can be produced.

Brief Description of the Drawings

[0012] **Figure 1** displays a glove having an activated warning sign;

[0013] **Figure 2** displays a glove having an appearing warning sign; and

[0014] **Figure 3** displays a glove having a progressive warning sign.

Detailed Description of Invention

[0015] Many industries and applications use color changing labels and printing inks. The triggering mechanism can be exposure to light, heat, moisture, chemical reaction of two components, and some component of air, such as oxygen or carbon dioxide. Colorless indication can be one end of a color changing process as well. In other words, an indicator can appear or disappear upon being triggered. Because the color changing is also environment dependent, the gloves will not pinpoint the exact time. Instead, a rough range is specified: less than 30 minutes, 30 - 60 minutes, and longer than 1 hour, and so on. Additionally, the indicator can show a first color at less than 30 minutes, a second color between 30 - 60 minutes, and a third color when longer than 1 hour. The color changing is gradual, and not a sharp change.

[0016] If the ink is added into the glove dipping compound, the whole glove will change color over time. The ink can be sprayed on a certain portion of the glove. A company logo can be sprayed onto the glove and it can be made to disappear as the indicator, or a message such as Atime to change@ can be made to appear. The inks can also be provided separately for glove wearers as stamps or self-stickers. The glove wearers can apply them at the time they put the gloves on, or as desired.

[0017] If the color changing is reversible, the manufacturing process and storage requirement is very flexible. Otherwise,

special precautionary measures have to be applied.

[0018] Figures 1 to 3 show the gloves with indicators incorporated therein. They demonstrate color change before and after activation, via various triggering mechanisms. Figure 1 depicts a glove **10** having a colored warning symbol **14** changing from a first color, seen in Figure 1a to a second color, seen in Figure 1b, indicating that the glove needs to be changed. Figure 2a depicts a glove **10** having a warning symbol **16,** which may be a message, appearing, as shown in Figure 2b to indicate that the glove need to be changed. This would work in reverse for a symbol that disappears when the glove needs to be changed.

Figures 3a-c shows a progressive symbol **18** on glove **10** changing colors over time to give an indication of elapsed time. The glove displays a first color, shown in figure 1a for the first 30 minutes of use, a second color seen in figure 3b from 30-60 minutes of use and a third color, seen in Figure 3c after 60 minutes. For all embodiments, the colors displayed by the gloves are a function of the material used for the warning sign.

[0019] The demonstrated methods can be applied to all disposable gloves, such as natural rubber latex, nitrile butadiene rubber, polyisoprene polychloroprene, polybutadiene rubber, butyl rubber, polyvinyl chloride, polyurethane, styrene ended copolymer thermal elastomers, as well as their blends, copolymers, and multiple structured composites. These methods are independent from the glove matrix materials involved and can be applied to gloves either on-line or off-line. This gives great flexibility to the glove manufacturers to implement the processes.

Example 1: UV sensitive indicator

[0020] UV sensitive material, sometimes called photo chromatic material, is sensitive to UV light. The color of the material changes when exposed to a UV light source, such as sunlight. When photo chromatic materials are exposed to UV light, they absorb the energy and use that energy to change their molecular structures. The new structures will have different color absorption and reflection abilities than the original structures. Thus, visible color changing occurs. This depends on the materials used. A color change can also be altered and the time span for the color change is adjustable. The color change process can be reversible, molecular structure changes back to original once UV light is absent, or irreversible, once the molecular structure is changed by UV source, it remains at new form even when UV source is absent. One possible material usable as a UV sensitive indicator is a mixture of dye pigment and UV activated materials such as the spiro-indoline-oxazines family, for example CTI Photo UV yellow, a commercially available material from Chromatic Technologies, Inc.

Example 2: Indoor visible light sensitive indicator

[0021] Similar to UV sensitive materials, fluorescent light sensitive materials are sensitive to fluorescent light such as indoor visible light. The mechanism is very similar to the UV mechanism. The only difference is that visible light activates the molecular structure change of the material, resulting in a visible color change. A different color change can be achieved using different materials. Again, the color change process can be reversible or irreversible and depends on different chemicals used. One possible material usable as a visible light sensitive indicator is a mixture of dye pigment and silver salts, for example C WC Ag 1, a commercially available material from Spectra Group Limited, Inc..

[0022] The glove manufacturing process is a little more difficult, in that the glove manufacturing operation can=t be entirely in the dark. Indicators with lower wavelength activation, known as blue side, are preferred. The manufacturing operation can be conducted with limited red light exposure.

Example 3: Carbon dioxide (pH) sensitive indicator

[0023] There are many pH indictors used for acid base titration. One is thymolphthalein, colorless at pH < 9.3 and dark blue at pH > 10.5. The indicator system also contains sodium hydroxide, a commonly used base. It adsorbs any accessible acidic substance. In the application to a glove, the indicator goes from dark blue to colorless. The chemical reaction upon air exposure is as follows:

$$2NaOH \xrightarrow{CO_2} Na_2CO_3 + H_2O \xrightarrow{CO_2} 2NaHCO_3$$

[0024] Although this reaction is reversible, strict avoidance of any acidic substances during manufacturing process is recommended and storage needs to be airtight. One possible material used as a carbon dioxide sensitive indicator is a mixture of a pH indicator, such as thymolphthalein and base or acid solution, such as sodium hydroxide and sold by

Penguin Magic Inc. as Disappearing Ink.

Example 4: Oxygen sensitive indicator

[0025] Indicators for oxidation-reduction titration can serve as time indicators. Similar to carbon dioxide sensitive gloves, airtight storage has to be adopted. One possible material used as a oxygen sensitive indicator is a mixture of thiazone dye pigment and aliphatic organic compounds, such as RP Systems oxygen indicators from Mitsubishi Chemicals.

Example 5: Chemical reaction activated indicator

[0026] Strictly speaking, all of the above indicators are activated by chemical reaction. The glove has to gain an extra component from the environment; energy such as light or heat or components form the air such as oxygen and carbon dioxide.

[0027] The gloves can be made with certain components inside or on the a glove. They can provide some other ingredients separately as a self-sticker. The glove wearer can apply this self-sticker onto the glove after the glove is put on. Once the contact between the reactive ingredients occurs, the desired color change would result over a predetermined period. This would allow a more flexible and friendly manufacturing and storage requirement.

[0028] When the elapsed time is less than 30 minutes, the color is yellow. Gradually, it turns orange, the wearer would know the glove has been donned for 30 to 60 minutes. If the color is pink, it means the glove has been put on for longer than one hour. One possible material used as a chemical reaction activated indicator is a mixture of dye pigment, alkaline substance and ascorbic acid and salt, for example TT sensor, a commercially available chemical reaction activated indicator from Avery Dennison.

Example 6: Body heat activated indicator

[0029] There are many heat sensitive indicators. However, many of them are not suitable for application to a glove because the temperature of the glove while on wearer=s hands should not dramatically change. However, an indicator that is dark blue at room temperature and turns light green at elevated temperature can be used. The color change occurs when the temperature reaches ~ 31 °C, which is lower than body temperature. The indicator is dark blue during normal storage conditions. After it has been put on, the body temperature of the hand would turn the indicator light green in less than 30 minutes. One possible material used as a body heat activated indicator is a mixture of dye pigment, diaryl; phthalides and acidic phosphoric acid ester compounds, for example, SB Screen 31C, a commercially available ink from Chromatic Technologies, Inc.

[0030] We can also combine some of these methods and technologies. For instance, an oxidation-reduction titration indicator can be combined with a sodium chlorite. Upon light exposure, sodium chlorite will decompose and release chlorine and chlorine dioxide. Both are strong oxidizers causing color change of many oxidation-reduction indicators.

[0031] The indicators can be single component and multiple components. It can be entirely or partially embedded into a glove. It can have components separately as self-stickers. It can be ingredients of a glove-dipping compound and can be sprayed over the surface.

[0032] The visual change can be a simple color change from one color to another color with one of the colors bring colorless, or a sign appearing or disappearing. The color indication can be any symbol, a company logo, or a message and could encompass the entire glove.

Claims

1. A glove comprising
a finger portion;
a palm portion extending from said finger portion;
a back portion opposite said palm portion, and
a time indicator signaling the time elapsed.

2. The glove of claim 1, wherein
said time indicator is a symbol appearing on said glove after a preselected period of time.

3. The glove of claim 2, wherein
said symbol is a text message.

4. The glove of claim 1, wherein
said time indicator is a symbol on said glove disappearing after a preselected period of time.

5. The glove of claim 1, wherein
said time indicator is on said back portion.

6. The glove of claim 1, wherein
said time indicator is activated by carbon dioxide, oxygen, visible light, ultraviolet light, heat, or a chemical reaction between two components.

7. The glove of claim 6, wherein
said time indicator is activated by carbon dioxide or oxygen.

8. The glove of claim 6, wherein
said time indicator is activated by visible light or ultraviolet light.

9. The glove of claim 1, wherein
said time indicator is a symbol having a first initial color and a second color after a first time period has elapsed.

10. The glove of claim 9, wherein
said symbol has a third color after a second time period has elapsed.

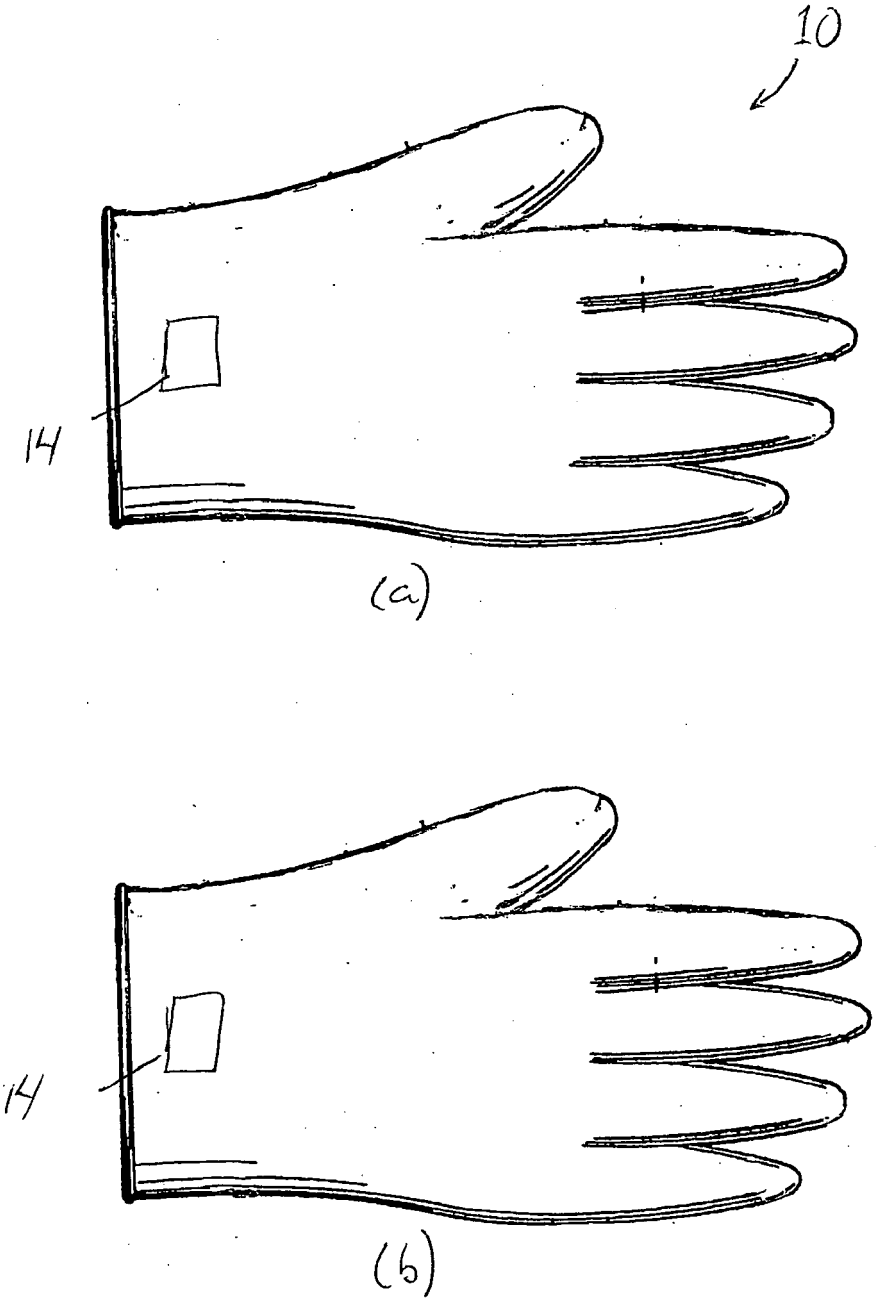


Figure 1

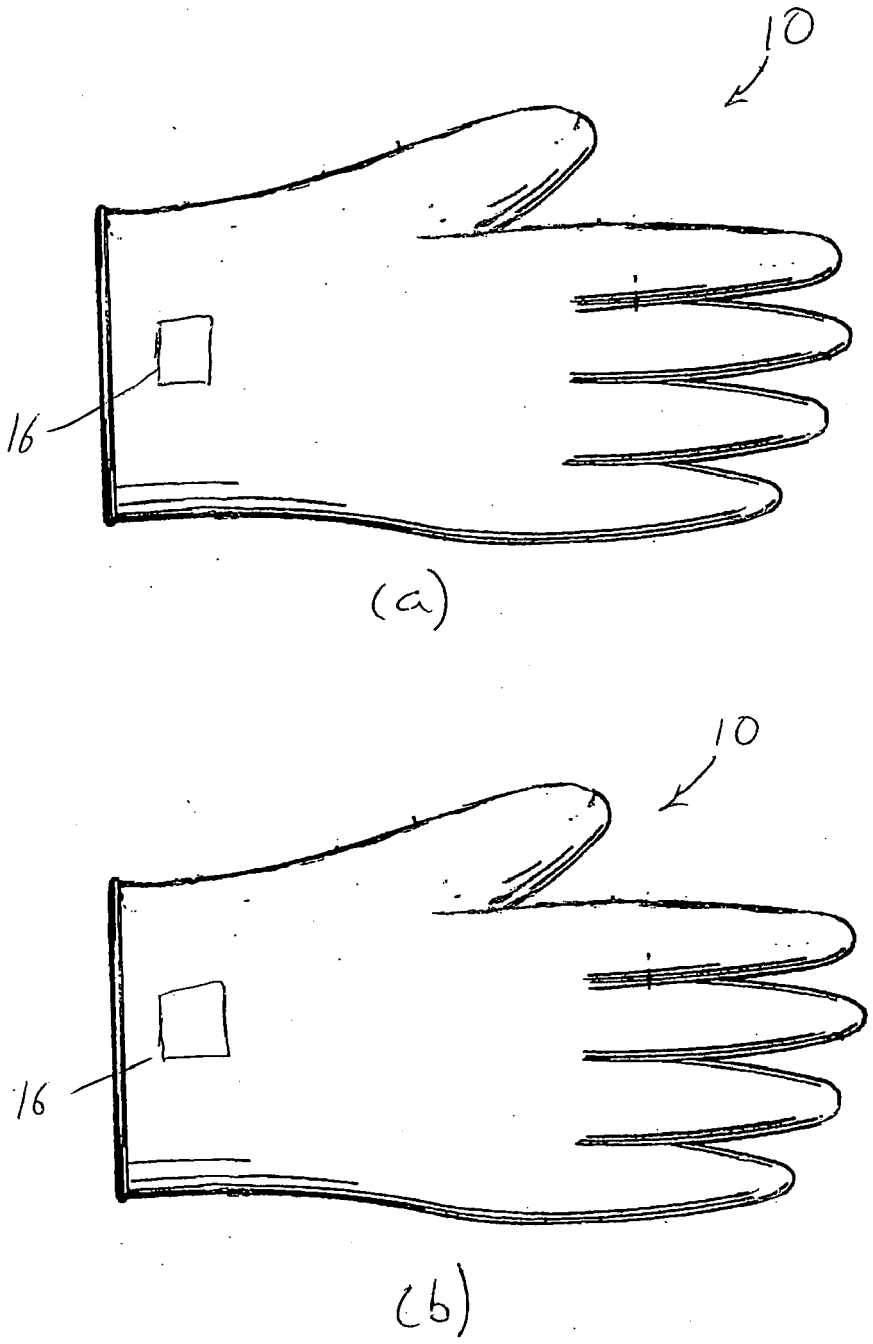
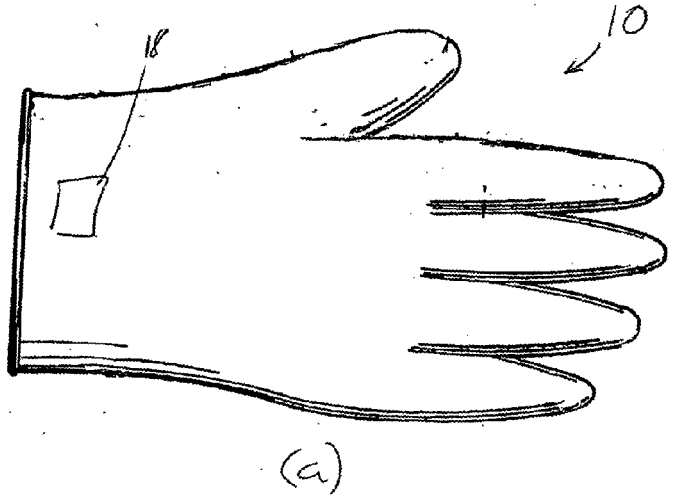
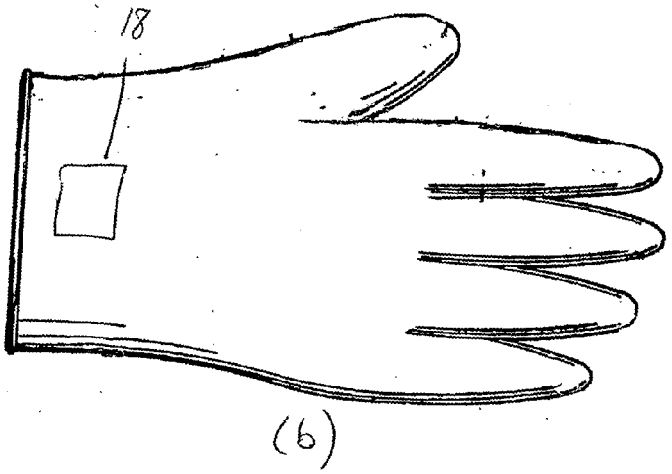


Figure 2





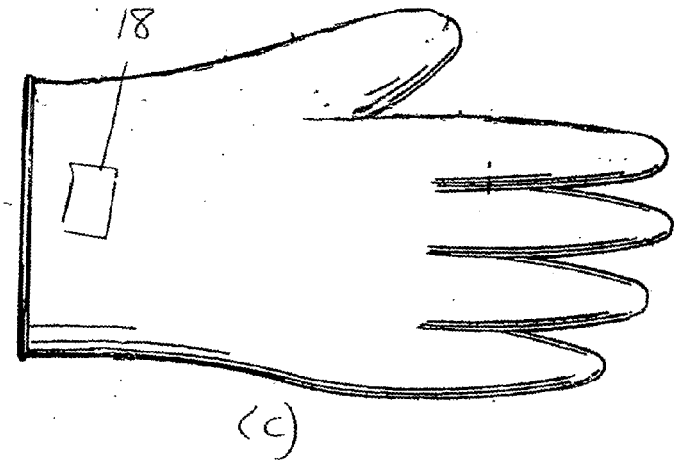


Figure 3