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Photochromic composition.

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A photochromic liquid composition comprises a solution of an azo compound of the type of carbazone such as dithizone and a metal haloid in a solvent with or without additional dyes to be applied to transparent plastic surfaces such as spectacles, shopwindows, etc.

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"Photochromic composition"

The present invention relates to a photochromic composition having a selective and progressive absorption of the incident radiation. With the word photochromism it is meant the ability of a substance
5 to change in color, both when seen in transparence and in reflected light, as a function of the incident radiation intensity. More particularly for the present invention a transparent substance is considered photochromic when it darkens reversibly
10 when the level of the light passing therethrough increases. In general the photochromic effect is not always associated with or due to an attenuation of the incident radiation.

The object of the present invention is to realize
15 a photochromic liquid composition wherein the darkening of the compound is associated with an attenuation of the radiation passing therethrough, both in the visible and ultraviolet ranges of wavelengths.

It is evident the usefulness of a liquid composition
20 that is able to absorb progressively increasing fractions of the visible and ultraviolet radiation passing theretrough as a function of the increasing intensity of the radiation. More particularly such a substance can be applied to transparent surfaces,
25 both colored or plain, as a protection against excessive

brightness, glare etc. Such a composition provides therefore useful applications for sun-glasses, shop-windows, windshield, transparent plastic sheets, etc.

5 More particularly the invention relates to a composition of the above stated kind particularly suited for coating plastic materials. There are known inorganic or mineral lenses in spectacles for skiers or snow-goggles incorporating substances
10 that change their color as a function of the environment light also allowing a modest attenuation. Besides exhibiting a rather mild effect, the above known substances have the shortcoming that they can be employed only in a glass (inorganic) compound purposely
15 prepared so that the technique cannot be used with lenses obtained from organic materials. On the other hand it is desirable to avail of photochromic lenses built from organic materials that assure a greater strength, safety and lightness. Similar problems
20 and inconveniences arise in other applications where it is preferable or desirable the use of plastic materials in lieu of glass. Moreover the known techniques mentioned for sun-glasses and alike are not quite satisfactory since the lenses or the screen darken
25 but do not provide an effective shield against very intense light sources.

It is an object of the present invention to realize a photochromic compound in form of a liquid, having a progressively increasing absorption of the incident
30 radiation and suitable to be applied as a thin layer to transparent surfaces, colored or plain, of plastic

materials to form surfaces shielding as a function of the incident luminous intensity, both natural and artificial.

The composition according to the invention is
5 obtained in form of a solution in a suitable solvent or mixture of solvents, selected on the ground of the characteristics of the receiving plastic materials. The main components of the composition are an azo compound of the group of carbazone such as diphenylthio-
10 carbazone (or dithizone), di- β naphthylthiocarbazone, diphenylcarbazone, etc. and an haloid of a metal selected from the group consisting of Hg, Ag, Ni, Cu, Cr, Mo, Co and Ba. More particularly good results were obtained using mercurous chloride and iodide
15 conferring different oranges hues. As for the amounts by weight of these two substances it has been found that for 100 parts of carbazone or dithizone the amount of haloid can vary from 20 to 120 parts. More particularly the photochromic and attenuating
20 effects can be substantially detected at 20-30 parts of haloid and progressively increase to a maximum at about 100-120 parts of haloid. Above such amount a worsening of the effect was detected.

Furthermore it was found that the best ratio
25 between the amounts of haloid and the azo compound is about 1:1 and that the diphenylthiocarbazone produces a composition very sensitive to light.

As stated above the solvent or the mixture is chosen in view of the foreseen use of the composition.
30 For example in case the composition is to be applied over acetylcellulose or cellulose propionate, as a solvent will be selected toluene, ethyl lactate,

etc. For a methacrylate it will be chosen a chlorine added solvent such as chloroform mixed with other diluents whereas for a polycarbonate it will be used a solvent such as cyclohexane. The amount of
5 solvent exceeds 90% of the entire composition and more particularly the best results are obtained, as for the coating layer, when the amounts of carbazone and haloid dissolved into the solution are from
10 0,1 to 10 g/l. Moreover dyes of known types can be added in an amount comprised between 0,1 and 5% so as to modify the "natural" color under moderate lighting, of the solution or of the final product.

In case of spectacles and glasses it is preferable to have a basic orange color since it gives a better
15 visibility in fog or anyhow in absence of sun. Among the dyes the azo pigments and the anthraquinone pigments are preferable. The following examples illustrate some of the preferred compositions according to the invention.

20 Example 1

0.200 g of dithizone were dissolved into 300 g of toluene stirring the mixture until the dithizone was completely dissolved. 0.190 g of HgCl dissolved in 50 g of chloroform were then slowly added to
25 the solution that was continuously stirred. Thereafter the resulting solution was furthermore diluted with 150 g of toluene after which there was added a dying solution formed by 4% by weight of anthraquinone blue in a mixture of toluene and ethyl lactate previously
30 filtrated to remove the solids formed by the dyes. The amount of coloring solution added was between

1-5 g/l and a green photochromic composition was obtained.

Example 2

The same composition of Example 1 was prepared
5 but using anthraquinone yellow and red pigments
so to obtain, respectively, two different hues of
orange color for the final composition.

Example 3

The solution of Example 1 was prepared by dissolving
10 the dyes in a mixture of solvents formed by chloroform
and toluene. Azo pigments were also employed.

Example 4

The mixture in Example 1 was prepared by using
equal amounts of dithizone and HgCl_2 (0.200 g) and
15 using ethyl lactate as a solvent for the mercurous
chloride.

The composition of the above examples were applied
to organic lenses of glasses for skiers by different
means (painting, spraying, dipping), in order to
20 obtain lenses colored as desired. These were exposed
to direct sun rays and assumed a hue progressively
darkening up to the level of a smoked glass. By
using spectacles having such lenses a comfortable
vision was allowed even in presence of glare due
25 to snow reverberation and also when directly looking
at the sun. Anyhow, under reduced lighting such
as under a sky covered with clouds, the attenuation
was also reduced so that the glasses did not hinder
if worn even when a protection was not absolutely
30 necessary. Besides it was found that the sun-glasses
so obtained were sensible also to artificial sources

of light if particularly intense, such as bright neon lamps, searchlights, etc.

The lenses so obtained did not alter with the age maintaining the desired photochromic properties.

5 It is supposed that the fact is due to the almost complete reversibility of the photochemical reactions taking place in the composition when it is excited by a radiation of increasing level. Moreover it has been found that similar photochromic properties
10 can be imparted to sheets of transparent plastic material, e.g. sheets of cellulose acetate, by coloring the acetate grains with the complete solution and then injection molding the plastic material as a sheet or final product. Such use of the composition
15 of the invention is particularly suitable when the final product or the sheet are molded at a temperature not too high.

Whereas the invention has been disclosed referring to the use in protecting glasses for skiers, the
20 same is not to be limited to such use but extends to all the other applications wherein it is required an attenuation and/or a photochromic effect in a transparent surface of plastic material as a function of the incident light.

C L A I M S

1. A photochromic composition having a selective and progressively increasing absorption of the incident radiation, characterized in that it comprises a solution, in an organic solvent, of 0.5 to 3 g/l
5 of an azo compound of the group of carbazone, such as diphenylthiocarbazone, di- β naphthylthiocarbazone, diphenylcarbazone and of a metal haloid.
2. A photochromic composition as claimed in claim 1, characterized in that the metal of said haloid
10 is selected from the group consisting of Hg, Ag, Ni, Cr, Cu, Mo, Co and Ba.
3. A composition as claimed in claim 1 or 2, characterized in that said haloid is a chloride.
4. A composition as claimed in claim 1 or 2,
15 characterized in that said haloid is a iodide.
5. A composition as claimed in claim 3 or 4, characterized in that it includes one or more anthraquinone pigments.
6. A composition as claimed in claim 5, characterized
20 in that the solute comprises from 80 to 110 parts by weight of haloid and 100 parts by weight of dithiocarbazone, and that the metal of said haloid is Hg.
7. A composition as claimed in claim 1 to 6, characterized in that it is used as a coating of
25 organic lenses in sport glasses.
8. A composition as claimed in claim 1 to 6, characterized in that it is used as a coloring agent of plastic grains to be molded for manufacturing products having photochromic properties.