Fig. 1
1 SUPPORT
2 PHOSPHOR LAYER
3 EMULSION LAYER
4 ANTIABRASION LAYER

Fig. 2
5 SUPPORT
6 PHOSPHOR LAYER
7 EMULSION LAYER
8 EMULSION LAYER
9 ANTIABRASION LAYER

Fig. 3
11 SUPPORT
12 PHOSPHOR LAYER
13 PHOSPHOR LAYER
14 EMULSION LAYER
15 EMULSION LAYER
16 ANTIABRASION LAYER

Fig. 4
21 SUPPORT
20 SUPPORT
19 PHOSPHOR LAYER
23 PHOSPHOR LAYER
22 ADHESIVE LAYER
26 EMULSION LAYER
18 PHOSPHOR LAYER
27 ANTIABRASION LAYER
25 EMULSION LAYER
24 SUPPORT
28 ANTIABRASION LAYER
29 ADHESIVE LAYER

INVENTORS
RALPH KINGSLEY BLAKE
FRANCIS PETER ALLES

BY
ATTORNEY
PHOTOGRAPHIC ELEMENTS

Ralph Kingsley Blake, Highland Park, and Francis Peter Alles, Westfield, N.J., assignors to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware

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This invention relates to photographic elements comprising a sheet support, a layer of finely divided phosphor particles dispersed in a chlorosulfonated olefin and a contiguous light-sensitive silver halide layer. More particularly it relates to such elements wherein the support and contiguous layer have a high degree of flexibility.

An object of this invention is to provide improved photographic elements having a layer of fluorescent material. Another object is to provide such elements which have improved flexibility characteristics. Yet another object is to provide flexible photographic elements having an integral screen which are suitable for the production of radiographs. A further object is to provide such films which can be bent about a small radius without damage. Still other objects will be apparent from the following description of the invention.

It has been found that photographic elements having a phosphor layer possessing a high degree of flexibility can be made by dispersing finely divided phosphor particles in a chlorosulfonated olefin addition polymer from a mono- or diolein of not more than 5 carbon atoms and coating the resulting layer on a flexible sheet support, e.g., a hydrophobic film, a thin sheet of metal such as aluminum, or paper, or on a light-sensitive colloid silver halide layer coated on the support. In the case where the phosphor layer is coated directly on the surface of the support or on a suitable anchor layer on such surface a colloid silver halide emulsion layer is coated on the phosphor layer, either directly or through an intervening adhesive layer. In one aspect of the invention the phosphor layer is placed between two colloid silver halide emulsion layers.

As will be apparent from the above general statement, there are many different specific types of photographic elements having the novel flexible phosphor layer which come within the scope of the present invention. The phosphor layer may be a permanent part of the element or may be provided with its own support and detachably joined through an adhesive layer to a colloid silver halide layer on a permanent support. A flexible film base may have a colloid silver halide emulsion layer on each surface and a phosphor layer, which may be detachable, e.g., by means of an adhesive layer, and, if desired, coated onto a support. In all cases where the colloid silver halide layer is an outer layer, or upon removal of a contiguous or adjacent phosphor layer would become an outer layer, it is preferable to have the surface of the light-sensitive silver halide layer provided with a protective, i.e., an antiblurion layer.

Several representative embodiments of the present invention are illustrated in the accompanying drawings, wherein each of the figures shows a cross-sectional view of a photographic element of this invention. The elements and thickness of the layers are shown in exaggerated enlargement for purposes of clarity and are not drawn to exact scale.

In the embodiment illustrated by Fig. 1, a support 1 bears on its surface flexible phosphor layer 2, which in turn bears on its surface emulsion layer 3. Layer 3 may optionally be overcoated with an antiblurion layer 4.

In the embodiment illustrated by Fig. 2, a support 5 and adjoining phosphor layer 6 have emulsion layers 7 and 8 on each side of the phosphor coated support. The emulsion layers are themselves overcoated with an antiblurion layers 9 and 10.

In the embodiment illustrated by Fig. 3, a support 11 is coated on each side with phosphor layers 12 and 13, each of which in turn are coated with emulsion layers 14 and 15, each of which in turn may be overcoated with an antiblurion layers 16 and 17.

In the embodiment illustrated by Fig. 4, phosphor coated supports composed of phosphor layers 18 and 19 coated on supports 20 and 21 are joined adjacent the phosphor layers by means of adhesive layers 22 and 23 to opposite sides of an element of a support 24 coated on each side with emulsion layers 25 and 26, each of which in turn bear an overcoating of an antiblurion layers 27 and 28.

In preparing the phosphor dispersions for coating to form a phosphor screen layer, the phosphor particles are dispersed in a suitable organic solvent including hydrocarbons, e.g., benzene, toluene, tetrahydrophthalene, decylhydrophthalene, chlorinated hydrocarbons, e.g., chloroform, carbon tetrachloride, trichloroethylene and tetrachloroethylene; or a ketone, e.g., methyl ethyl ketone and cyclohexanone. If desired, with the aid of a dispersing agent, e.g., tetrasopropyl titanate, diocyl ester of sodium sulfoacetinic acid and mixtures of the latter with stearic acid, the dispersion is then admixed with the chlorosulfonated olefin addition polymer, the resulting solution is coated onto the support, or appropriate layer on the support, e.g., colloid silver halide layer, antiblurion layer or adhesive layer, and the solvent or solvents are removed, e.g., by evaporation at room temperature or at elevated temperature. The chlorosulfonated olefin addition polymer preferably is added from solvent solution to the dispersion of phosphor. For convenience, the solvent can be the same as that used in the original phosphor dispersion. In order that the phosphor particles will be of fine particle size and free from agglomerates and slugs of polymer binding agent, the dispersion is milled, e.g., by means of a colloid mill or ball mill and then passed through a fine-mesh screen, filter cloth, or felt. By this procedure, the phosphors will have a particle size approximately 3 to 6 microns in average diameter. The phosphor layers may vary in thickness from 0.001 to 0.015 inch.

Various adjuvants may be admixed with the phosphor dispersion in the olefin polymer. Among such adjuvants are vulcanizing agents, e.g., magnesium oxide, lead oxide, and organic amines; vulcanizing accelerators, e.g., zinc dibutyldithiocarbamate and 2-mercaptoimidazoline; plastificiers, e.g., diocylphthalate, and resins, e.g., coumarone-indene resins and the "Epon" resins having the formula:

\[
\begin{align*}
\text{CH}_3 & \quad \text{OH} \\
\text{R} & \quad \text{O} \quad \text{R'} \quad \text{C} \quad \text{R} \quad \text{O} \quad \text{CH}-\text{CH} & \quad \text{CH}-\text{CH} & \quad \text{CH}-\text{CH} & \quad \text{CH} \\
\end{align*}
\]

wherein R is

\[
\begin{align*}
\text{CH}_3 & \quad \text{CH}_3 \\
\text{CH}_3 & \quad \text{CH}_3 \\
\end{align*}
\]

and R' is p-phenylene (sold by Shell Chemical Corporation). In general, the added resins should constitute not more than 50% by weight of the chlorosulfonated olefin polymer.

Chlorosulfonated olefin addition polymers useful as the binding agents and their preparation are described in U.S. patents, McQueen, 2,212,786; McAlevy, 2,416,060 and 2,416,061. They contain chlorine in the form of \(-\text{SO}_2\text{Cl}\)
groups and as chlorine atoms attacked directly to carbon atoms of the polymer chain, and the chlorine on a percentage basis will vary from 20 to 45% by weight, at least 0.4% of which will be in $SO_3Cl$ groups and the amount of sulfur in the form of such groups will vary from 0.4% to 3.0% by weight.

The ratio of phosphor particles to the chlorosulfonated olefin addition polymer may vary from 5 to 30 parts of the former per part by weight of the latter. The amount will vary with the particular polymer, but, in general, best results are obtained with 15 to 20 parts of the phosphor per part of polymer.

As stated above, the supports may be composed of various polymers. Among the useful polymers are cellulose derivatives, e.g., cellulose acetate, cellulose propionate, cellulose acetate propionate, cellulose acetate butyrate, ethyl cellulose; polyvinyl chloride, poly(vinyl chloride co vinyl acetate); vinylidene chloride copolymers with vinyl chloride, vinyl acetate, acrylonitrile, styrene and methyl methacrylate, and polystyrene and polyesters, e.g., polyethylene terephthalates and homologous polymers obtainable by the processes described in Whinfield et al. U.S. Patent 2,465,319. These film bases may contain or be coated with dyes or finely divided pigments, e.g., Titanium White (Colour Index No. 64002, Victoria Green YB Base (C.I. No. 657), Chinoline Yellow D Sol. in Spirits (C.I. No. 800), Nubian Resin Black (C.I. No. 864), TiO$_2$, lithopone, magnesium carbonate, aluminum oxide, carbon black or colored pigments as opacifying or light-absorbing agents.

In a preferred aspect of the invention, a flexible support such as paper, waterproof paper or a hydrophobic film having a thickness from 0.00025 to 0.015 inch is provided with a layer of a barium sulfate/lead sulfate mixed crystal phosphor dispersed in a chlorosulfonated polyethylene, wherein the phosphor is applied at a coating weight of 0.5 to 15.0 grams per square decimeter and 5 to 20 parts of phosphor per part by weight of chlorosulfonated polyethylene over which is provided a light-sensitive colloidal silver halide emulsion layer having a silver halide coating weight of 5 to 150 milligrams per square decimeter.

The invention will be further illustrated but is not intended to be limited by the following examples, wherein the silver halide coatings and subsequent treatment and use of the composite elements, prior to controlled exposure to actinic radiations, were protected from such radiations.

**Example 2**

A mixture of the following materials was ball milled for 24 hours and strained through naiscoinik:

- **Toluene** ml... 435.0
- Tetrapropyl titanate g... 3.6
- BaSO$_4$/PbSO$_4$ phosphor g... 2250.0
- Stearic acid g... 3.0

A 25% by weight solution in toluene of a chlorosulfonated polyethylene containing approximately 27.5% chlorine and 1.5% sulfur, wherein most of the chlorine is substituted along the hydrocarbon chain and the sulfur is combined with chlorine and attached to the carbon chain as sulfonyl chloride ($SO_2Cl$), was stirred into the above mixture to give a barium sulfate/lead sulfate mixed crystal phosphor to chlorosulfonated polyethylene binder ratio of 15 to 1 on a weight basis. The resulting phosphor suspension was applied to waterproof paper (made by coating a conventional clay coated paper on both sides with a cellulose nitrate lacquer) by means of a doctor blade to give an air dried thickness of 0.005 inch and a phosphor coating weight of about 3.5 grams/cm$^2$. An X-ray type gelatino-silver bromoidide emulsion containing 1.5 mol percent silver iodide and 98.5 mol percent silver bromide was coated at 96°F. on the phosphor layer to a weight of about 24 mg. of silver salt per square decimeter (calculated as silver bromide) and the result-

ing element was dried. A gelatin antiabrasion layer was coated at 100°F. over the emulsion layer to a weight of about 10 mg. gelatin/dm$^2$ and the layer was dried.

A sample sheet of the resulting photographic film containing an integral intensifying screen, illustrated by Fig. 1, was given an 0.8-second unscreened X-ray exposure at 70 kVp, 30 ma. and 36-inch distance through a 1 inch thick aluminum machine part. The X-ray exposed material was substituted for the paper negative in a Polaroid X-ray packet and then processed for 1 minute in a Picker-Polaroid processing unit as described in J. A. Reynolds' article, "A Preliminary Report on the Picker-Polaroid Process in Industrial Radiography," Non-Destructive Testing, Summer Number, 1952, pages 24 to 27. The resulting positive paper radiograph showed similar but more sharply defined detail as compared with a radiograph obtained with a standard Polaroid X-ray packet exposed under the same conditions for 0.6 second in a Picker-Polaroid cassette containing a fluorescent intensifying screen and processed for 1 minute in the Picker-Polaroid processing unit. Exposure times were adjusted in the usual manner to give comparable positive prints.

In another test a second sample sheet of the photographic paper was given a 0.8-second X-ray exposure as described above, developed at 68°F. for 45 seconds in a conventional aqueous metal-hydroquinone developer fixed in a conventional aqueous fixing composition containing sodium thiosulfate, washed and dried to give a low contrast sharp negative radiograph, when viewed by either reflected or transmitted light.

The effective speed and contrast of a conventionally processed integral emulsion-screen product exposed for 0.3 second as described above was increased by intensification in the iron toner formula given in U.S. Patent 2,699,994, Example IX, except that the Wool Orange dye was omitted. The processing was carried out at 68°F. as follows: a 45-second development and 1½ minutes fixing in the solutions described above, a 3-minute wash in water, a 2-minute toning treatment in the toner just described and a 1-minute wash in water. After drying, the resulting negative radiograph was satisfactory for viewing by either reflected or transmitted light alone, or with the aid of colored filters.

An X-ray sensitive element made as described above but without the BaSO$_4$/PbSO$_4$ chlorosulfonated polyethylene phosphor layer required a 25-second exposure to give a negative radiograph of the same quality as that obtained by the 0.8-second exposure of the photographic paper having the integral BaSO$_4$/PbSO$_4$ layer, using the same processing conditions.
100° F. over the emulsion layer to a weight of about 10 mg. gelatin per square decimeter and dried.

A sample sheet of the resulting photographic paper having an integral phosphor screen, illustrated by Fig. 1, was given a 0.6-second unexposed X-ray exposure similar to that of Example 1. The emulsion surface of the exposed element was placed in contact with a special imaging-receptive coating on 0.005 inch triacetate made as directed in Example 2 of U.S. Patent 2,352,014. The two elements were then inserted into the slots of a two-slot "Apeco Auto-Stat" processing machine for copies up to 14 x 17 inches, made by the American Photocopy Equipment Company, 55 E. 34th Street, New York 16, N.Y. In this machine, the two elements were pulled through a developing solution of the following composition by electrically driven rubber rollers in about 8 seconds. During passage through the machine, the sheets were held apart by metal guides to assure uniform wetting of each sheet by the developing solution, which follows:

Water ...........................................grams 750
Sodium sulfite (anhydrous) .................do 45
Hydroquinone ..................................do 16.5
Boric acid .....................................do 5
Potassium bromide .............................do 2.0
Sodium thiosulfate (anhydrous) ............do 15
(a) Ethanol containing Sterox CD (50:1 by volume) ......ml 5
(b) Methanol containing 1-phenyl-5-mercaptotetrazole (1 gram per 1000 ml) ..............ml 6
Sodium hydroxide .......................grams 24
Water to make 1 liter.

The Sterox CD of the above table is a polyoxymethylene ester of a tall oil acid made by Monsanto Chemical Company.

The two sheets of material emerged from the machine adhered together face to face and in a semi-dry condition due to the squeezing action of the rubber rollers. After about two minutes of surface contact, the sheets were peeled apart to reveal a positive transparency on the receptive sheet and a negative image in the emulsion layer of the photographic film having the integral screen. The negative image was formed by conventional development of the exposed silver salt image. The positive image was formed by silver transfer development. The unexposed silver halide of the negative emulsion dissolved in the developer and diffused to the surface of the receptive layer where the silver was precipitated by the catalytic action of the specially treated surface to give a positive image.

Similar results can be obtained by substituting for the processing machine described in the preceding example the processing machine described in Canadian Patent 487,883.

**Example 3**

A highly flexible photographic film with a combined intensifying screen was made by substituting for the waterproof paper of Example 1 a 0.0025 inch sheet of biaxially oriented polyethylene terephthalate film bearing on both sides a tricomponent polymer sub-layer overcoated with a gelatin subbing layer as described in Alles et al. U.S. Patent 2,627,088. This film-screen element was exposed and inverse transfer developed in contact with an image-receptive sheet as described in Example 2 to give sharp negative and positive images in the photographic and image-receptive layers, respectively.

**Example 4**

In a manner analogous to Examples 1 and 3, a flexible phosphor intensifying screen layer and support were made consisting of a 0.005 inch thick coating of BaSO₄/Phospho- in a chlorosulfonated polyethylene binder on one side of a 0.0025 inch polyethylene terephthalate film of the type described in Example 3. An X-ray type gelatino-silver bromide emulsion layer containing 1.5 mol percent silver iodide and 98.5 mol percent silver bromide overcoated with a gelatin antiblusion solution were applied to each side of the phosphor coated film base to weights of about 80 mg. silver salt (calculated as silver bromide) and 10 mg. gelatin, respectively, per square decimeter and the resulting composite element was dried.

The resulting flexible photographic film with the integral intensifying screens, illustrated by Fig. 2, was bent to conform to an inside cylindrical surface of the 1¼ inch thick aluminum part referred to in Example 1, and exposed through a 1¼ inch thickness of aluminum at 70 kVp., 3A ma., X-radiation at a distance of 28 inches for 0.3 second and then developed for 5 minutes in a solution made by admixing the following components:

N-methyl-p-aminophenol sulfate ..........grams 2.5
Sodium sulfite (anhydrous) ...............do 75.0
Hydroquinone ................................do 3.0
Borax ........................................do 5.0
Water to make 1.0 liter.

and fixed at 68° F. for 5 minutes in a solution made by admixing the following components:

Sodium thiosulfate .......................grams 240
Sodium sulfite ..............................do 6
Boric acid ..................................do 6
Potassium alum .............................do 12
Acetic acid (28%) .........................ml 35
Water to make 1 liter.

The finished radiograph, after washing, contained an image disclosing the internal structural of the part, when viewed by either reflected or transmitted light.

**Example 5**

In a manner analogous to Examples 1 and 3, flexible phosphor intensifying layers of the chlorosulfonated polyethylene/BaSO₄/Phospho- in a chlorosulfonated polyethylene/CaWO₄ mixtures previously described were coated to a dry thickness of 0.005 inch on opposite sides of 0.0025 inch polyethylene terephthalate film of the type described in Example 3. An X-ray gelatino-silver bromide emulsion containing 1.5 mol percent silver iodide and 98.5 mol percent silver bromide was coated on the BaSO₄/Phospho- layer and the emulsion layer was in turn coated with an aqueous gelatin solution to form an antiblusion layer of weights of about 17 mg. calculated as silver bromide for the emulsion layer and 10 mg. gelatin for the antiblusion layer per square decimeter, respectively, and the coated element was dried. A high speed negative non-optically sensitized gelatino-silver bromide emulsion, 3.4 mol percent silver iodide and 96.6 mol percent silver bromide, was coated on the CaWO₄ layer and an aqueous gelatin solution was coated on the emulsion layer to form an antiblusion layer, of weights of about 22 mg., calculated as silver bromide for the emulsion layer and 10 mg. gelatin for the antiblusion layer, respectively, per square decimeter and the coatings were dried.

A sample sheet of the resulting highly flexible photographic film having integral screens, illustrated by Fig. 3, was given a 0.2-second unexposed X-ray exposure as described in Example 1 and then developed and fixed at 68° F. for 5 minutes each in the developer and fixing formulas described in Example 4. The finished radiograph after washing when viewed by reflected light showed images of different contrast on opposite sides of the radiograph. The image was also adequate, when viewed by transmitted light.

In another test, a second sample sheet of the composite photographic film/screen was given a 0.6-second unexposed X-ray exposure similar to Example 1. Both sides of the exposed element were contacted with sheets of white waterproofed paper whose contacting surfaces
had been coated with the special image-receptive layer as described in U.S. Patent 2,352,014, Example 2. The assembly of the three elements in juxtaposition was then inverse transfer developed in a manner similar to Example 2 to add two positive prints of the image-receptive layer of the papers and two negative images in the emulsion layers of the processed integral photographic emulsion-screen element.

Example 6

An element similar to that described in Example 3 was made by substituting a non-optically sensitized high-speed negative gelatino-silver halide emulsion coated to a weight of 36 mg. silver halide per square centimeter for the X-ray type emulsion of that example. The resulting integral emulsion-screen element was then exposed and inverse developed as described in Example 2 to give a sharp positive transparency in the image-receptive film element.

Example 7

The chlorosulfonated polyolefins/BaSO4/PbSO4 phosphor suspension of Example 1 was applied to a conventional baryta photographic paper base by means of a doctor blade to give an air dried thickness of 0.005 inch and a phosphor coating weight of about 3.5 grams per square inch. The phosphor layer was coated by means of a doctor blade with a mixture of 8 parts by weight of an epoxidized soy oil of molecular weight of about 1000 (made by Rohm and Haas) and 10 parts of a 12% (by weight) solution of the chlorosulfonated polyolefin of Example 1 dissolved in toluene to give a dry, pressuresensitive adhesive coating of about 0.001 inch thickness. Under safe lights, a sheet of the adhesive coated phosphor screen was squeezed firmly onto opposite surfaces of a piece of conventional X-ray film, containing 1.5 mol percent silver iodide and 98.5 mol percent silver bromide, to form the flexible integral emulsion-screen product, illustrated by Fig. 4. The product was given a 0.2-second X-ray exposure similar to Example 1, the screens removed, and the X-ray film processed in conventional fashion as described in Example 4 to give a clear, sharp, contrast radiograph. To obtain similar results on unscreened X-ray film the exposure had to be increased from 0.2 second to 6 seconds.

Still other image-receptive elements useful with the photographic elements having an integral phosphor screen of this invention are described in the following patents: 2,352,014; 2,698,236; 2,698,237; 2,698,245 and 2,705,676.

While in the above examples a specific chlorosulfonated polyolefin was used as the binding agent for the phosphor particles, the invention is not limited to this particular polymer. Various other chlorosulfonated polyolefin elastomers or mixtures of elastomers having the constitution and properties outlined above can be used in like manner.

In place of the gelatin which is used as a binding agent for the light-sensitive silver halide, there may be substituted other water-permeable or hydrophilic colloids, which are insoluble in aqueous photographic developing, fixing, etc. solutions. Suitable colloids include agar-agar, polyglycronic acid, hydrophilic polymers, e.g., polyvinyl alcohol and acetal thereof; hydrophilic cellulose derivatives, e.g., ethyl cellulose, cellulose acetate containing 20 to 25% of solubilizing groups, such as acid phosphate groups, etc.

The gelatin silver halide emulsion layers may contain in addition to the light-sensitive silver halide, e.g., silver chlorides, silver-bromide-chlorides, silver bromoiodide, etc., various sensitizing dyes and other materials which are common in emulsion layers. Such additional materials include fog inhibiting agents, emulsion hardeners, emulsion preservatives, etc.

In place of the specific fluorescent pigments of the above examples, there can be substituted other such materials which exhibit fluorescence under the influence of X-rays such as zinc sulfide. Agents which prevent afterglow can be added if desired so that the intensification will not be prolonged after X-ray exposure has been completed.

Flexible integral emulsion-screen products may be substituted for the inflexible X-ray photographic film-intensifying screen combinations currently used in medical and industrial radiography. The new products may also prove useful for autoradiography and high resolution cine-radiography of small objects. The new products may be modified to make screened X-ray exposures in white light without the use of a cassette or cardboard X-ray film holder of the type shown in Reuter U.S. Patent 2,590,892. This may be accomplished by substituting black-backed optically opaque paper for the paper support of the screenable flexible intensifying screens of the integral emulsion-screen product described in Example 4. The phosphor layers are highly flexible and do not crack or peel when bent about a small radius, and while they are extremely thin have an adequate amount of phosphor to produce the desired image on the screen.

X-rays of a continuous silver halide emulsion layer.

A special product useful for making phototemplates and reproducing engineering drawings can be made using the elements of the present invention wherein a phosphor layer is coated on a thin, flexible metal sheet, e.g., aluminum and then overcoated with an emulsion layer. When the emulsion layer is exposed to light through an engineering drawing or X-rays or gamma radiation through a metal pattern, and developed and fixed, an element is formed having a negative silver image over the fluorescent layer. This element in turn can be copied on a photographic paper or metal surface bearing a photographic emulsion by exposing to X-rays in a manner known to the art. The great flexibility of the product makes it possible to conform it to the surface of cylindrical objects to be reproduced and also facilitates storage in rolls, in addition the use of a metal support results in greater dimensional control and reproducibility.

The integral screen/photographic emulsion products of the invention wherein the emulsion is coated over the fluorescent layer which is in turn coated on an opaque base material, such as heavy cardboard or metal are also useful in the preparation of relief images for planographic or letterpress printing. By using metal stencils of type matter, line drawings, etc., and X-ray exposure, it is possible to expose the elements in a manner such that the strongest exposure takes place next to the base. When elements exposed in this way are processed in a hardening developer, e.g., one containing pyrogallol and the non-image areas washed off in hot water in the manner known to the art, a relief image firmly anchored to the base is obtained. Because of their flexibility, such elements can be readily bent around printing cylinders, etc. for a variety of printing processes.

The integral photographic emulsion-screen elements of this invention have the following advantages: They are versatile; they may be exposed to gamma or X-radiation, while bent into uniform intimate contact on cylindrical or conical surfaces; they may be bent or folded prior to, during or following processing; they may be processed conventionally to give sharp negative images of different contrast on different sides of a single support, when viewed by reflection or still different contrast when viewed by transmission; or they may be processed by inverse transfer development to provide positive prints or transparencies.

A major advantage of the new elements of this invention is that they eliminate the need for separate screens and yield gamma and X-ray sensitive materials which are useful and easily handled for industrial and medical radiographic work.

The invention claimed is:

1. A photographic element comprising a sheet support bearing at least one layer of light-sensitive silver halide dispersed in a water-permeable colloid binding agent and
a coactive flexible screen layer comprising finely divided particles of a phosphor dispersed in a chlorosulfonated addition polymer of an olefin containing 1 to 2 olefinic double bonds and not more than 5 carbon atoms.

2. An element as set forth in claim 1 wherein said support is flexible and said olefin is ethylene.

3. An element as set forth in claim 2 wherein said phosphor consists of BaSO₄/PbSO₄ mixed crystals.

4. An element as set forth in claim 2 wherein said support is very thin and is composed of a polyethylene terephthalate.

5. An element as set forth in claim 2 wherein said support is paper.

6. An element as set forth in claim 2 wherein said coactive layer is adjacent the support.

7. An element as set forth in claim 6 wherein an anti-abrasion layer is superposed on the silver halide layer.

8. An element as set forth in claim 2 wherein said coactive layer is adjacent the support and the layer of silver halide can be stripped from said coactive layer.

9. An element as set forth in claim 8 wherein the layer of silver halide is carried by a separate support.

10. A photographic element comprising a flexible hydrophobic film base bearing on each surface a flexible screen layer comprising finely divided particles of a phosphor dispersed in a chlorosulfonated ethylene addition polymer and a coactive layer of light-sensitive silver halide on at least one of said screen layers.

11. An element as set forth in claim 10 wherein a coactive layer having an antiabrasion layer is on each screen layer.

12. A photographic element comprising a sheet support bearing at least one layer of light-sensitive silver halide dispersed in a water-permeable colloid, an antiabrasion layer on each layer of silver halide, an adhesive layer on each antiabrasion layer, a flexible screen layer comprising finely divided particles of a phosphor dispersed in a chlorosulfonated ethylene addition polymer on each adhesive layer and a paper support for each screen layer.

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