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⑤④ **X-ray intensifying screens.**

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Description

This invention relates to X-ray intensifying screens used with photographic film elements to record X-ray images thereon, and particularly to screens having improved imaging characteristics. Still more particularly, this invention relates to X-ray screens having controllable speed and to radiographs produced therefrom which exhibit good image sharpness and reduced noise.

X-ray intensifying screens made by incorporation of a luminescent phosphor in a binder and coated on a suitable support are well-known in the prior art. These X-ray screens absorb X-rays and emit energy in the form of light, which in turn exposes a photographic film associated therewith. The phosphors used in these screens can be generally segregated into three classes: (1) broad band emitters (e.g. CaWO_4); (2) narrow band emitters (e.g. BaFCl:Eu); and (3) line emitters (e.g. LaOBr:Tm). Conventionally, the X-ray screens made with these phosphors are used with radiographic, silver halide film to record X-ray images. In the field of medical X-ray the use of X-ray screens is particularly useful, since there is a pressing need to reduce patient dosage to potentially harmful X-rays. Screens serve to greatly increase the overall system speed, thus requiring less X-ray output to generate a satisfactory image.

One method of increasing speed is to increase the thickness of the phosphor coating. As speed increases, however, there is usually a decrease in image sharpness and thus a decrease in the amount of medical information that can be generated by this system. Conventionally, the speed of an X-ray screen is reduced by lowering the thickness of the phosphor layer or by adding broad band absorbers (e.g. dyes or pigments) to the X-ray screen structure. Controlling screen speed by these prior art methods yields the desired higher sharpness but also increases the noise and mottle of the finished radiograph prepared therefrom.

Radiographic noise is a grain or mottle pattern which results from the statistical nature of the imaging process. A source of noise is the distribution of scintillation efficiencies of the individual phosphor crystals. Those crystals with low efficiency may only contribute minimally to the imaging process while those with high efficiency lead to increased density. The fluctuations in developed density appear as noise. By narrowing the distribution of scintillation efficiencies, radiographic noise should be lowered, and broadening it will increase noise. As discussed above, the addition of dyes or pigments to the screen structure effectively broadens the distribution of scintillation efficiencies, thus increasing the noise.

The X-ray screen structure conventionally consists of a phosphor-containing layer coated on a suitable support. It is also beneficial to use an underlayer (e.g. reflective or absorbing layer) coated between the phosphor and the support and to include a protective overcoat for the phosphor layer.

It is an object of this invention to provide an improved X-ray screen prepared with phosphors exhibiting narrow band or line emissions. It is another object of this invention to provide X-ray screens which can be used with photographic film to achieve controlled speed, good image sharpness, and low noise and mottle.

According to one aspect, the present invention provides an X-ray intensifying screen comprising, in order, (1) a support, (2) optionally an underlayer, (3) an active layer comprising a phosphor exhibiting narrow or line band emission dispersed in a non-polyurethane containing binder, and (4) optionally an overcoat layer, characterised in that at least one of layers (2), (3) and (4) contains a non-fluorescing ultraviolet (UV) light absorber having absorbance maxima at about 400 nm or below and in that said active layer (3) comprises a said phosphor exhibiting narrow or line band emission selected from the group consisting of LaOBr:Tm , LaOBr:Tb , Y(Nb)TaO_4 , LaOCl:Bi and BaFCl:Eu . An X-ray screen made according to the invention, used with a photographic film, will produce a sharper image with lower noise and mottle, compared with a screen made without the UV absorber.

X-ray intensifying screens comprising (1) a support, (2) optionally an underlayer, (3) an active layer (comprising a phosphor exhibiting narrow or line band emission dispersed in a non-polyurethane binder, e.g. polyvinyl butyral) and (4) optionally an overcoat layer, but not containing UV absorber in layers (2), (3) or (4) are known, for example from US—A—4076897 (Joiner).

X-ray intensifying screens containing a UV absorber are also known from US—A—3743833 (Martic et al) but in such screens the phosphor is dispersed in a polyurethane binder. Furthermore the use of a UV absorber specifically with narrow or line band phosphor to greatly improve the image quality of these highly efficient materials has not been shown.

It may also be noted that FR—A—2066273 discloses photographic film containing a UV absorber and provided on each face used with an X-ray intensifying screen. This document in particular discloses in Example 2, product D, such a film provided with X-ray intensifying screens in which the phosphor is the broad band emitter Ba(Pb)SO_4 .

There are a number of commercially available UV light absorbers that exhibit absorbance maxima at about 400 nm or below. All will function within the ambit of this invention. These include the following:

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	Absorber	Absorption max. (nm)
5	A 2-(2'-hydroxy-3',5'- dialkylphenyl) benzotriazole	~400
10	B 2,2'-dihydroxy-5- alkoxy-benzophenone	~400
15	C 2-(2'-hydroxy-3'- alkylphenyl) benzotriazole	~400
20	D p-methoxybenzylidene malonic acid, dimethyl ester	~330
25	E essentially a carboxylated vinyl acetate terpolymer which includes, as part of its chain, a copolymerized UV light absorber	Trade Name & Co. Resyn 28-3307, National Starch Bridgewater, NJ ~330
30	F oxalic anilide derivative	Sanduvor ALB Sandoz Inc., E. Hanover, NJ ~330
35	G oxalic anilide derivative	Sanduvor VSU, Sandoz Inc. ~330

These absorbers can be dissolved in any convenient organic solvent (e.g. acetone) and added either to layer (2), (3) or (4) in amounts which depend on the effect desired and the layer to which they may be added.

Layer (1) is a support. A number of elements can be used such as paper or metal foil, e.g., aluminum. It is preferred to use a macromolecular, hydrophobic organic polymer support. Suitable polymeric supports include cellulose derivatives, e.g., cellulose acetate, cellulose propionate, cellulose acetate butyrate, and ethyl cellulose; polyethylene, polyvinyl chloride, poly(vinyl chloride covinyl acetate), polyvinylidene chloride, polyvinyl acetate, polyacrylonitrile, polystyrene, and polyisobutylene; and polyesters, e.g., polyethylene terephthalates and homologous polyesters obtainable by the process described in Whinfield et al., US—A—2,465,319. Polyethylene terephthalate films are particularly useful because of their dimensional stability. A particularly useful support is biaxially oriented polyethylene terephthalate coated with a subbing layer of vinylidene chloride - methylacrylate - itaconic acid copolymer as described in Alles et al., US—A—2,779,684. The thickness of the support may conveniently be anywhere from about 0.0025 inch to 0.03 inch (0.0064 cm to 0.0762 cm) with 0.01 inch (0.0254 cm) being preferred.

The support, moreover, may contain or be coated with dyes or finely divided pigments, e.g., titanium oxide, lithopone, magnesium carbonate, aluminum oxide, carbon black, and colored pigments, e.g. tartrazine (C.I. No. 640), Victoria Green W.B. Base (C.I. No. 800), and Nubian Resin Black (C.I. No. 864), as opacifying or light-absorbing agents. The above mentioned dyes and pigments are particularly useful in reflective layers to vary the light output or block unwanted wavelengths. In addition, the base support may be metallized to provide reflective action, e.g., the polyethylene terephthalate base can be coated with a thin layer of aluminum. It is preferred to apply a reflective layer comprising anatase grade TiO₂, dispersed in chlorosulfonated polyethylene (e.g., Hypalon 20, E. I. du Pont de Nemours and Company, Inc., Wilmington, DE), on the support. A number of other reflective pigments can also be used in the reflective layer. These include the potassium titanates of Brixner, US—A—3,895,157, among others.

The phosphors are usually milled for several hours in a solvent/binder mixture and coated over the above referenced reflective layer. A number of binders can be used in the active layer (3) of this invention. It is preferred to use polyvinyl butyral resins but there are a host of suitable polymers used in the prior art that can be used here.

Polyurethane elastomeric binders, while particularly effective because of their adhesion to the conventional supports described above, are, however, subject to degradation by UV light. Many of the

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conventional phosphors emit substantial amounts of UV light which can further be reflected back into the active layer by the support; so steps must be taken to prevent this degradation (see Martic et al supra). Thus binders other than polyurethanes are used according to the invention.

A protective overcoat made according to any of the teachings of the prior art may be applied over the phosphor layer. These top coats can be cellulose nitrate or acetate or a mixture of resins comprising poly(methylmethacrylate), poly(isobutyl methacrylate), and vinyl chloride/vinyl acetate copolymers as taught by Patten, US—A—2,907,882. An overcoat similar to that described in Brixner et al in U.S. 3,895,157 is particularly efficacious. The overcoat layer can be from about 0.0001 inch to 0.005 inch (0.0003 cm to 0.013 cm) in thickness. It is preferred to use the fluoracrylate overcoats of Joiner, USSN 420,486, filed September 20, 1982, a copy of which application is on the European Patent Office file of the present application. A corresponding European Patent Application No. 83109212.7, was filed on 17 September 1983 and was published as EP—A—103874.

An X-ray screen prepared as described above, and in the examples that follow, is eminently useful in medical radiography, for example. The addition of the UV light absorber permits one to control the speed of the screen in a predictable fashion. Thus, these screens, when exposed in conjunction with X-ray photographic film will exhibit excellent image sharpness and, importantly, noise and mottle is reduced. This allows more information to be determined from the image. This is a considerable and surprising finding over the prior art which teaches thickness reduction in the phosphor layer to improve image sharpness with a concurrent rise in noise and mottle.

In a preferred aspect, the invention provides an X-ray intensifying screen composed of, in order, (1) a film-forming polyester support, (2) an underlayer comprising TiO_2 dispersed in chlorosulfonated polyethylene, (3) an active layer comprising LaOBr:Tm dispersed in polyvinyl butyral, and (4) an overcoat layer consisting essentially of a fluoroacrylate polymer, wherein at least one of layers (2), (3) and (4) contains an effective amount of a nonfluorescing UV light absorber having absorbance maxima below about 400 nm.

The invention will now be illustrated by the following non-limiting examples.

Example 1

Three X-ray intensifying screens were made comprising, in order, a support (1), a reflective layer (2), an active phosphor layer (3), and an overcoat layer (4). In this example, the UV light absorber was placed in layer (4). The reflective suspension was prepared by sandmilling a mixture of the following ingredients for about 4 hours:

	Ingredient	Wt. %
35	Anatase TiO_2	28.4
	n-butyl acetate	35.1
40	Mixed petroleum naphtha, initial B.P. 247°F (119°C)	23.5
	Diocylester of sodium sulfosuccinic acid	1.1
45	Polymeric organic silicone fluid (2% by weight in toluene)	0.6
50	Chlorosulfonated polyethylene (Hypalon 20)	11.3

The milled suspension was filtered through a filtering medium with an average pore-size of 30 microns. The suspension was deaerated and then coated on a sheet of biaxially oriented polyethylene terephthalate film provided with a substratum of vinylidene chloride - methylacrylate - itaconic acid copolymer prepared as described in US—A—2,698,240. A reflective layer was obtained which gave a TiO_2 coating weight of about 0.029 g/inch² (0.0045 g/cm²).

After drying this layer at about 70—75°F (21.1—23.9°C), an active phosphor layer was applied on the reflective layer. The phosphor layer was prepared from the following composition, milled for about 12 hours:

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	Ingredient	Wt. %
	LaOBr:Tm	58.3
5	Polyvinylbutyral ⁽¹⁾	5.6
	n-butyl acetate	16.8
	n-propanol	16.8
10	Polymeric organic silicone fluid	0.8
	Potassium salt of monoethylphenylphenol monosulfonic acid	0.2
15	Glycerol monolaurate	1.4

⁽¹⁾Granular, intrinsic visc. of 0.81.

20 On the dried phosphor layer an overcoat layer was applied from the following solution:

	Ingredient	Wt. %
25	Cellulose acetate (acetyl content of 55.8%)	6.5
	Acetone	92.4
	Urea-formaldehyde resin	0.9
30	2-heptadecyl-N,N-ethyl, hydroxyethyl-isoimidazole ethyl sulfate salt	0.1
35	High boiling waxy compound (Acrawax C, Glyco Chemicals, Inc. Greenwich, Conn.)	0.1
	UV light absorber	.04

40 Three screens were prepared. Screen I contained UV light absorber (A), Screen II contained UV light absorber (B), and Screen III contained UV light absorber (C) at the levels shown above. For control, a screen was prepared without any UV light absorber.

45 The above referenced screens were tested by exposure with a high speed medical X-ray film to an X-ray unit at 80 KVp, 2 mAs through a 2 mm aluminum filter. A step wedge and a resolving power target were placed between the X-ray source and the film/screen (in direct contact therewith). Each exposed film was then developed, fixed and washed in a conventional X-ray developing system, and the following results were obtained:

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Film sensitometry

Screen ⁽³⁾ sample	Rel. speed ⁽¹⁾	Resolution (l.p./mm)	Mottle (rms granularity at D=1.00) ⁽²⁾
Control	1.71	8.3	.014
Screen I (A)-Tinuvin 328	.98	8.0	.011
Screen II (B)-Cyasorb UV-24	.96	8.5	.012
Screen III (C)-Cyasorb UV-5411	1.05	7.7	.012

⁽¹⁾In all cases the speed is relative to that obtained by exposure of Du Pont Hi-Plus screens and conventional blue-sensitive X-ray film where this speed=1.00.

⁽²⁾low numbers=low mottle (see US—A—4,028,550 at column 4, last paragraph).

⁽³⁾UV absorber is identified in brackets.

Thus, it is seen that addition of the UV light absorber to the overcoat layer (4) significantly reduces the mottle produced by the screen, improving the overall image quality of a film exposed thereto.

Example 2

A screen was prepared as in Example 1 except that UV light absorber (B) was instead added to the active phosphor layer (3) at a level of 0.12% by weight of the phosphor (LaOBr:Tm). The following results were obtained:

Film sensitometry			
Screen sample	Rel. speed	Resolution	Mottle
Control	1.76	8.8	.017
Of this invention	1.05	8.9	.014

Obviously the resolution was increased and the mottle significantly reduced when UV light absorber (B) was placed in the phosphor layer (3).

Example 3

To test the efficiency of this invention when a UV-light absorber was added to the reflective layer, a screen was made as in Example 1 except that UV light absorber (B) was instead added directly to the reflective suspension at a level of 0.18% by weight of the TiO₂. The following results were obtained:

Film sensitometry			
Screen sample	Rel. speed	Resolution	Mottle
Control	1.45	8.6	.012
Of this invention	.82	8.6	.010

Example 4

A UV light absorber may also be used in conjunction with a light absorbing underlayer. To test this effect, an active phosphor suspension (see Example 1) containing 0.53% of UV light absorber (B) was coated directly on a polyethylene terephthalate film support which contained sufficient carbon to yield an optical density greater than 8.0 (opaque base). This simulates the application of an absorbing underlayer (vs. reflective underlayer in the previous examples). The following results were obtained when this screen was used to expose a high speed X-ray film as taught in Example 1:

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Film sensitometry

Screen sample	Rel. speed	Resolution	Mottle
Control	1.00	10.4	.014
Of this invention	.65	10.4	.012

Example 5

To compare screens prepared according to the teachings of this invention with prior art screens, three screens were made with the following structure:

support (1)	—same as Example 1
reflective layer (2)	—same as Example 1
phosphor layer (3)	—same as Example 1 except for coating weight and additives (see table, below)
overcoat layer (4)	—same as Example 1 excluding the UV absorber

In Screen I the phosphor layer was coated at a 0.022 inch (0.056 cm) thickness, and UV light absorber (B) at 0.52 wt.% on the phosphor was added. Screen II contained no additive and was coated at a 0.012 inch (0.030 cm) thickness. Screen III contained 1.7 ml of a 1% solution of solvent Yellow 3 Dye (C.I. No. 11160:1), a monazo dye dissolved in acetone. The following results were obtained when these screens were used to expose samples of high speed medical X-ray film as described in Example 1:

Film sensitometry				
Screen sample	Phosphor coat. thickness in mils (mm)	Rel. speed	Resolution	Mottle
I of this invention	22 (0.56)	0.93	9.3	.011
II undyed	12 (0.30)	0.93	10.4	.015
III 1.7 ml dye soln.	22 (0.56)	0.99	11.1	.013

When coated at a thinner coating weight than the screen of this invention, the dyed screens (prior art elements) were ca. 40% higher in mottle, although somewhat sharper in resolution. When dye is added to a screen of comparable thickness, the screen is ca. 20% higher in mottle. Thus, the screen which embodies this invention can greatly improve the signal/mottle ratio and yield an overall improved image on an X-ray film exposed therewith.

Example 6

CaWO₄ is an example of a broad band-emitting phosphor outside the scope of this invention. Three screens were made employing the following structure:

The support (1) and reflective layer (2) were the same as described in Example 1. The phosphor layer (3) contained CaWO₄ in place of LaOBr:Tm of Example 1. The overcoat layer (4) was the same as Example 1 except for the UV light absorber. Screen I contained no UV light absorber. Screen II contained 0.52 weight % of UV light absorber (B) and Screen III contained 0.52 weight % of UV light absorber (A), based on cellulose acetate.

These screens were used to expose high speed medical X-ray film as taught in Example 1, with the following results:

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Film sensitometry

	Screen sample	Rel. speed	Resolution	Mottle
5	I no UV absorber	0.51	8.4	.008
	II UV absorber (B)	0.45	8.6	.008
10	III UV absorber (A)	.51	8.2	.008

As can be seen from these results, in comparison with Example 1, for instance, there is no effect on overall image quality when the UV light absorbers are used with broad band-emitted phosphors.

Example 7

Example 6 was repeated substituting Ba(Pb)SO₄ (another broad band-emitting phosphor) with the following results:

Film sensitometry

	Screen sample	Rel. speed	Resolution	Mottle
20	I no UV absorber	0.33	9.1	.009
25	II UV absorber (B)	0.22	9.1	.009
	III UV absorber (A)	0.21	9.0	.008

Here too, the UV light absorber failed to significantly improve the image quality of the film exposed to a screen having the broad band-emitting Ba(Pb)SO₄ phosphor.

Example 8

To test the effects of the UV light absorber in yet another phosphor system, a screen was prepared as described in Example 1 using Y(Nb)TaO₄ (narrow band emitter) phosphor in the active layer (3) and 0.52 wt.% of UV light absorber (B) in the overcoat layer (4). The following results were obtained:

Film sensitometry

	Screen sample	Rel. speed	Resolution	Mottle
40	I control, no UV absorber	0.72	9.5	.012
45	II with UV absorber	0.57	9.1	.009

The improvement in image quality is noted here.

Example 9

Yet another phosphor having a narrow emission band is LaOCl:Bi. Two screens having this phosphor were prepared according to the teachings of Example 1. Screen I was prepared without a UV light absorber while Screen II contained 0.52 wt.% of UV light absorber (B) in the overcoat layer. The screens were used to expose high speed medical X-ray film with the following results:

Film sensitometry

	Screen sample	Rel. speed	Resolution	Mottle
60	I no UV absorber	0.90	10.8	.017
65	II UV absorber (B)	0.71	12.2	.013

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Example 10

Example 9 was repeated using BaFCI:Eu (narrow band emitter) as the phosphor and with 1.04 wt.% of UV light absorber (B) in the overcoat layer. The following results were noted:

5	Screen sample	Film sensitometry		
		Rel. speed	Resolution	Mottle
10	I control, no UV absorber	1.30	8.0	.013
	II with UV absorber	0.73	8.7	.011

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The improvement in image quality is noted here.

Example 11

Example 10 was repeated using LaOBr:Tb (line emitter) as the phosphor and with 0.52 wt.% of UV light absorber (B) in the overcoat layer. The following results were noted:

25	Screen sample	Film sensitometry		
		Rel. speed	Resolution	Mottle
	I control, no UV absorber	1.61	7.7	.012
30	II with UV absorber	1.21	8.0	.011

The improvement in image quality is noted here.

As can be seen from the preceding examples the use of the UV light absorber within X-ray screens made according to the teachings of this invention, which are limited to those luminescent phosphors that have their primary emission as line or narrow bands, produces an X-ray intensifying screen which has greatly improved imaged characteristics in film used therewith. This was not possible in the prior art which taught that one must reduce the coating weight of the phosphor layer in order to achieve good resolution and subsequently found that the image was noisy. Images produced with the screens of this invention have excellent sharpness and, at the same time, have lower noise.

Claims

1. An X-ray intensifying screen comprising, in order, (1) a support, (2) optionally an underlayer, (3) an active layer comprising a phosphor exhibiting narrow or line band emission dispersed in a non-polyurethane containing binder, and (4) optionally an overcoat layer, characterized in that at least one of layers (2), (3) and (4) contains a nonfluorescing ultra-violet (UV) light absorber having absorbance maxima at about 400 nm or below and in that said active layer (3) comprises a said phosphor exhibiting narrow or line band emission selected from the group consisting of LaOBr:Tm, LaOBr:Tb, Y(Nb)TaO₄, LaOCl:Bi and BaFCI:Eu.

2. A screen as claimed in claim 1 wherein the UV light absorber is a member of the group consisting of a 2 - (2' - hydroxy - 3',5' - dialkyl - phenyl)benzotriazole, a 2,2' - dihydroxy - 5 - alkoxy - benzo-phenone, and an oxalic anilide derivative.

3. A screen as claimed in either of claims 1 and 2 wherein the phosphor is LaOBr:Tm.

4. A screen as claimed in any one of claims 1 to 3 wherein the binder is polyvinyl butyral.

5. A screen as claimed in any one of claims 1 to 4 wherein an underlayer (2) is interposed between support (1) and active layer (3).

6. A screen as claimed in claim 5 wherein said underlayer contains said nonfluorescing UV light absorber having absorbance maxima below 400 nm.

7. A screen as claimed in any one of claims 1 to 6 wherein the support contains or is coated with opacifying dyes, reflective dyes, or finely divided pigments.

8. A screen as claimed in any one of the preceding claims wherein said support (1) is formed from a film forming polyester.

9. A screen as claimed in any one of the preceding claims wherein an underlayer (2) comprising TiO₂ dispersed in chlorosulfonated polyethylene is interposed between support (1) and active layer (3).

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10. A screen as claimed in any one of the preceding claims having an overcoat layer (4) comprising a fluoroacrylate polymer.

11. A screen as claimed in claim 1 composed of, in order, (1) a film-forming polyester support, (2) an underlayer comprising TiO_2 dispersed in chlorosulfonated polyethylene, (3) an active layer comprising LaOBr:Tm dispersed in polyvinyl butyral, and (4) an overcoat layer consisting essentially of a fluoroacrylate polymer, wherein at least one of layers (2), (3) and (4) contains a nonfluorescing UV light absorber having absorbance maxima below about 400 nm.

10 Patentansprüche

1. Röntgenstrahlenverstärkungsschirm, umfassend, in der angegebenen Reihenfolge,
(1) einen Träger,
(2) gegebenenfalls eine Unterschicht,
15 (3) eine aktive Schicht, die einen eine Schmal- oder Linienband-Emission, aufweisenden Phosphor dispergiert in einem nicht-polyurethanhaltigen Bindemittel umfaßt, und
(4) gegebenenfalls eine Überzugsschicht,
dadurch gekennzeichnet, daß wenigstens eine der Schichten (2), (3) und (4) ein nicht-fluoreszierendes, ultra-violettes (UV) Licht absorbierendes Material mit einem Absorptionsmaximum bei etwa 400 nm oder
20 darunter enthält und daß die aktive Schicht einen genannten, eine Schmal- oder Linienband-Emission aufweisenden Phosphor umfaßt, der aus der aus LaOBr:Tm, LaOBr:Tb, Y(Nb)TaO₄, LaOCl:Bi und BaFCl:Eu bestehenden Gruppe ausgewählt ist.

2. Schirm nach Anspruch 1, worin das UV-Licht absorbierende Material ein Glied der aus einem 2 - (2' - Hydroxy - 3',5' - dialkylphenyl)benzotriazol, 2,2' - Dihydroxy - 5 - alkoxybenzophenon und einem
25 Oxalanilid-Derivat bestehenden Gruppe ist.

3. Schirm nach einem der Ansprüche 1 und 2, worin der Phosphor LaOBr:Tm ist.

4. Schirm nach irgendeinem der Ansprüche 1 bis 3, worin das Bindemittel Polyvinylbutyral ist.

5. Schirm nach irgendeinem der Ansprüche 1 bis 4, worin eine Unterschicht (2) zwischen dem Träger (1) und der aktiven Schicht (3) eingelagert ist.

30 6. Schirm nach Anspruch 5, worin die Unterschicht ein nicht-fluoreszierendes, UV-Licht absorbierendes Material mit einem Absorptionsmaximum unterhalb von 400 nm enthält.

7. Schirm nach irgendeinem der Ansprüche 1 bis 6, worin der Träger undurchsichtig machende Fabstoffe, reflektierende Farbstoffe oder feinteilige Pigmente enthält oder damit beschichtet ist.

8. Schirm nach irgendeinem der vorhergehenden Ansprüche, worin der Träger (1) aus einem
35 filmbildenden Polyester gebildet wird.

9. Schirm nach irgendeinem der vorhergehenden Ansprüche, worin eine TiO_2 in einem chlorosulfonierten Polyethylen umfassende Unterschicht (2) zwischen dem Träger (1) und der aktiven Schicht (3) eingelagert ist.

10. Schirm nach irgendeinem der vorhergehenden Ansprüche mit einer Überzugsschicht (4) aus einem
40 Fluoroacrylat-Polymer.

11. Schirm nach Anspruch 1, bestehend, in der angegebenen Reihenfolge, aus

(1) einem Träger aus einem filmbildenden Polyester,

(2) einer TiO_2 in einem chlorosulfonierten Polyethylen umfassenden Unterschicht,

(3) einer LaOBr:Tm dispergiert in Polyvinylbutyral umfassenden aktiven Schicht und

45 (4) einer im wesentlichen aus einem Fluoroacrylat-Polymer bestehenden Überzugsschicht, worin wenigstens eine der Schichten (2), (3) und (4) ein nicht-fluoreszierendes, UV-Licht absorbierendes Material mit einem Absorptionsmaximum unterhalb von etwa 400 nm enthält.

Revendications

50 1. Un écran intensificateur de rayons X comprenant, dans cet ordre, (1) un support, (2) facultativement une sous-couche, (3) une couche active comprenant une substance fluorescente présentant une émission de bande étroite ou de raies dispersée dans un liant ne contenant pas de polyuréthane et (4) facultativement une couche supérieure de revêtement, caractérisé en ce que l'une au moins des couches
55 (2), (3) et (4) contient un agent absorbeur de lumière ultraviolette non fluorescent qui présente des maxima d'absorption à environ 400 nm ou en-dessous et en ce que ladite couche active (3) comprend une substance fluorescente présentant une émission de bande étroite ou de raies choisie dans le groupe formé par LaOBr:Tm, LaOBr:Tb, Y(Nb)TaO₄, LaOCl:Bi et BaFCl:Eu.

2. Un écran tel que revendiqué dans la revendication 1, dans lequel l'agent absorbeur de lumière
60 ultraviolette est un membre du groupe formé par un 2 - (2' - hydroxy - 3',5' - dialkylphényl)benzotriazole, une 2,2' - dihydroxy - 5 - alcoxy - benzophénone et un dérivé de l'anilide oxalique.

3. Un écran tel que revendiqué dans l'une quelconque des revendications 1 et 2, dans lequel la substance fluorescente est LaOBr:Tm.

4. Un écran tel que revendiqué dans l'une quelconque des revendications 1 à 3, dans lequel le liant est
65 du butyral polyvinyle.

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5. Un écran tel que revendiqué dans l'une quelconque des revendications 1 à 4, dans lequel une sous-couche (2) est intercalée entre le support (1) et la couche active (3).

6. Un écran tel que revendiqué dans la revendication 5, dans lequel ladite sous-couche contient ledit agent absorbant de lumière ultraviolette non fluorescent ayant des maxima d'absorption au-dessous de 40 nm.

7. Un écran tel que revendiqué dans l'une quelconque des revendications 1 à 6, dans lequel le support contient, ou est revêtu par, des colorants opacifiants, des colorants réfléchissants ou des pigments finement divisés.

8. Un écran tel que revendiqué dans l'une quelconque des revendications précédentes, dans lequel ledit support (1) est formé d'un polyester filmogène.

9. Un écran tel que revendiqué dans l'une quelconque des revendications précédentes, dans lequel une sous-couche (2) comprenant du TiO_2 dispersé dans du polyéthylène chlorosulfoné est intercalée entre le support (1) et la couche active (3).

10. Un écran tel que revendiqué dans l'une quelconque des revendications précédentes, comportant une couche supérieure de revêtement (4) comprenant un polymère de fluoroacrylate.

11. Un écran tel que revendiqué dans la revendication 1, composé, dans cet ordre, (1) d'un support en polyester filmogène, (2) d'une sous-couche comprenant du TiO_2 dispersé dans du polyéthylène chlorosulfoné, (3), d'une couche active comprenant du LaOBr:Tm dispersé dans du butyral polyvinylique, et (4) d'une couche supérieure de revêtement formée essentiellement d'un polymère de fluoroacrylate, dans lequel l'une au moins des couches (2), (3) et (4) contient un agent absorbant de lumière ultraviolette non fluorescent ayant des maxima d'absorption au-dessous d'environ 400 nm.

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