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PHOTOGRAPHIC LIGHT-SENSITIVE FILMS

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Anti-halation layers of photographic light-sensitive films are generally divided into two types, namely, a type where the anti-halation layer remains, but is decolored by processing, and a type where the anti-halation layer is removed by processing. This is the so-called film-removing type. The present invention relates to a photographic light-sensitive film having an improved anti-halation layer of the latter type and more particularly to a photographic light-sensitive film having an improved film-removing type anti-halation layer comprising an alkali-soluble resin.

A conventional anti-halation layer of the film-removing type is formed on a photographic light-sensitive film by coating on a back layer of the photographic light-sensitive film a solution prepared by dispersing or dissolving carbon black or an anti-halation dyestuff in a resin. The anti-halation layer of this type has a higher flexibility and smoothness than those formed from a gelatin layer which is frequently used in the case of adopting the film-remaining type anti-halation layer. The film-removing type anti-halation layer is removed at development. Therefore no sticking occurs when the back layer of the film is contacted with the emulsion layer after development. The anti-halation layer of this type has excellent anti-halation effect and further, since the anti-halation layer has an improved water-resistance, the photographic light sensitive film having the anti-halation layer can be easily handled even in a high humidity condition.

However, there is a drawback in the case of adopting the film-removing type anti-halation layer. Specifically, the anti-halation layer is transferred to the surface of an emulsion layer when it is contacted with the emulsion layer before development.

Therefore, an object of this invention is to provide an improved anti-halation layer which is not transferred to an emulsion layer when the anti-halation layer is contacted with the emulsion layer.

It is disclosed in U.S. Patent 2,732,305 that by the addition of a small amount of the primary amide of organic carboxylic acid having 7 to 17 carbon atoms shown by the following general formula

$$RCONH_2$$

wherein R is an aliphatic hydrocarbon chain having 7 to 17 carbon atoms, in the anti-halation layer composed of an alkali-soluble resin, the transfer of the anti-halation layer to the surface of an emulsion layer can be prevented.

We have found that the N-substituted amide derived from behenic acid, that is, the N-alkyl behenamide represented by the general formula

$$\begin{array}{c} C_{21}H_{43}CONH \\ \quad\quad\quad | \\ \quad\quad\quad R \end{array}$$

wherein R represents a methyl group or an ethyl group, shows a far better transfer-preventing effect and also has a smaller adverse effect on the photographic properties of the film.

The suitable proportion of the N-alkyl behenamide to be incorporated in the anti-halation layer is from $^{25}/_{100}$

to $^{1}/_{100}$ part by weight, and preferably $^{12}/_{100}$ to $^{2}/_{100}$ part by weight of the alkali-soluble resin of the anti-halation layer. If the proportion of the amide is less than $^{1}/_{100}$, the transfer-preventing effect is scarcely obtained and if the proportion is higher than $^{25}/_{100}$, the amide is separated from the anti-halation layer due to the poor compatibility of the amide with the resin.

As the alkali-soluble resins which may suitably be used in the present invention there are resins having carboxylic acids or the anhydrides thereof at the side chains, such as, maleic anhydride copolymers, cellulose acetate phthalate, acrylic acid copolymers, and the acetate phthalate of polyvinyl alcohol.

The material for the anti-halation layer is usually composed of the above-mentioned alkali-soluble resin, the alkyl behenamide, and carbon black or an anti-halation dye but by incorporating in the composition a surface active agent, the coating property and film-removing property of the thus formed anti-halation layer can be improved.

The surface active agent used in this invention may be various anionic surface active agents and non-ionic surface active agents and they may be used alone or as a mixture thereof.

Moreover, the invention is effective regardless of the kinds of support materials and anti-halation agents to be incorporated in the anti-halation layer and the manner of coating the substrate of the anti-halation layer.

The following examples are given by way of illustration and not limitation:

Example 1

To the back surface of a cellulose triacetate film was applied a solution having the following compositions to provide an anti-halation layer:

	Parts by wt.
Styrene-maleic anhydride copolymer	10
Sodium laurylsulfonate	1.2
Carbon black	4.8
N - ethyl - behenamide	1.0
n - Butanol	22.5
Acetone	480
Methanol	186

On a substrate formed on the opposite surface of the support there was coated a photographic emulsion. When the thus prepared photographic film was maintained for 2 days at a temperature of 30° C. and a relative humidity of 80% in a state that the anti-halation layer was contacted with the photographic emulsion layer, the anti-halation layer was not transferred to the emulsion layer. Further, when the film was maintained for 6 months at a temperature of 20° C. and at a relative humidity of 60% in the same state, the back layer was not transferred to the surface of the emulsion layer.

Example 2

An anti-halation layer was formed by applying to the back surface of a cellulose triacetate film a solution having the following composition:

	Parts by wt.
Vinyl acetate-maleic anhydride copolymer	10
Spirit black	4.8
Ethanol	600
Sodium laurylsulfonate	0.5
N - ethyl behenamide	1.0

A photographic emulsion layer was formed on a substrate on the opposite surface of the film and when the thus prepared film was rolled up firmly and stored in that condition for 1 year, the anti-halation layer was not transferred to the surface of the emulsion layer.

Example 3

A polyester which has been prepared by condensing a mixture having the following composition:

	Mols
Dimethyl terephthalate	1
Ethylene glycol	1.7
Triethylene glycol	0.8

with the addition of an ester exchange catalyst was mixed with cellulose triacetate in equal amount and the mixture was dissolved in a solvent mixture of ethylene chloride, methylene chloride, methanol, phenol, and tetrachloroethane. The thus prepared solution was applied to the back surface of a two-dimensionally stretched and oriented crystalline polyethylene terephthalate film and dried to provide a substrate.

On the thus prepared substrate was formed an anti-halation layer having the following composition:

	Parts by wt.
Styrene-maleic anhydride copolymer	10
Sodium laurylsulfonate	1.0
N-methyl behenamide	1.0
Acetone	150
Methanol	500
Cyclohexanone	60
Carbon black	6.5

After drying, the thus obtained anti-halation layer showed the anti-adhesion property almost the same as the case in Example 1.

Comparative example

Two anti-halation layers each containing stearamide and N-ethyl behenamide respectively were prepared as follows and the comparative test about the anti-adhesion property of the anti-halation layers was conducted.

That is, 2.5 parts of a maleic anhydride-styrene copolymer was dissolved in 5.6 parts of n-butanol by heating (butanol-denaturing) and, after the addition of 7 parts of acetone into the solution, 1.6 parts of carbon black and 0.25 part of sodium laurylsulfonate were dispersed in the solution. The solution was further diluted with 18 parts of acetone and 60 parts of methanol and the whole solution was divided into two parts, one of which was mixed with following solution A and another was mixed with solution B.

	Parts
Solution A:	
Stearamide	0.2
Methanol	20
Solution B:	
N-ethyl behenamide	0.2
Methanol	20

The thus prepared anti-halation coating solution was applied to the substrate of a polyester film and dried. A color photographic light-sensitive emulsion was applied to the opposite surface of the film and dried. When the thus prepared film was slit into 16 mm. in width and 50 m. in length, rolled up and maintained for 24 hours at a temperature of 40° C. and a relative humidity of 80%, no transfer of the anti-halation layer to the emulsion layer occurred in the case where solution B was used whereas the anti-halation layer containing solution A was transferred to the emulsion layer (average adhesion area was 10–20%).

By the comparative test, it is clear that the anti-halation layer containing the N-alkyl behenamide in this invention has higher anti-adhesion property than the anti-halation layer containing the aliphatic acid amide described in U.S. Patent 2,732,305.

What is claimed is:

1. A photographic light-sensitive film comprising a support having thereon at least one photographic light-sensitive emulsion layer and an anti-halation layer composed of an alkali-soluble resin and a member selected from the group consisting of carbon black and an anti-halation dye on the surface of the support opposite to the emulsion side, said anti-halation layer having incorporated therein an N-alkyl behenamide shown by the following formula:

$$\begin{matrix} C_{21}H_{43}CONH \\ \quad\quad\quad | \\ \quad\quad\quad R \end{matrix}$$

wherein R is a member selected from the group consisting of CH_3 and C_2H_5.

2. The photographic light-sensitive film of claim **1** wherein the proportion of the N-alkyl behenamide is $\frac{1}{100}$ to $\frac{25}{100}$, preferably $\frac{2}{100}$ to $\frac{12}{100}$ based on the weight of the alkali-soluble resin in said anti-halation layer.

3. The photographic light-sensitive film of claim **1** wherein said alkali-soluble resin is a maleic anhydride copolymer.

4. The photographic light-sensitive film of claim **1** wherein said alkali-soluble resin is cellulose acetate phthalate.

5. The photographic light-sensitive film of claim **1** wherein said alkali-soluble resin is an acrylic acid copolymer.

6. The photographic light-sensitive film of claim **1** wherein said alkali-soluble resin is the acetate phthalate of polyvinyl alcohol.

7. The photographic light-sensitive film according to claim **1** wherein said anti-halation layer further contains a surface active material.

8. The photographic light-sensitive film according to claim **7** wherein said surface active material is an anionic surface active agent.

9. The photographic light-sensitive film according to claim **7** wherein said surface active material is a non-ionic surface active agent and a mixture thereof.

10. The photographic light-sensitive film according to claim **7** wherein said surface active material is a mixture of anionic and non-ionic surface active agents.

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