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3,010,838 COATING COMPOSITION FOR SUBBING POLYSTYRENE FILM

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This invention relates to a coating composition for use in the production of a photographic film having a polystyrene base sheet.

Polystyrene film has heretofore been proposed for use as a photographic film support and is finding increasing commercial use for this purpose. A serious problem has heretofore been presented in securing a firm bond between the surface of a polystyrene base sheet and the light-sensitive coating of a gelatin-silver halide emulsion. Various solutions have been proposed for the solution of this problem.

One proposed solution has been the application of an intermediate subbing layer consisting of two or more coatings of different compositions. This solution to the problem has the disadvantage of requiring two or more coating operations to form the subbing, prior to the application of the light-sensitive coating, thereby increasing the cost of the product.

Another solution to the problem has involved the substitution of a special light-sensitive coating for the conventional gelatin-silver halide emulsion. This solution to the problem has the dual disadvantage of requiring a material and complex deviation from the normal procedures for the application of the conventional gelatin-silver halide emulsion coatings, with increased cost arising both from the more expensive ingredients used in the special light-sensitive coating composition and the complex procedure involved in the formulation of the light-sensitive coating composition. A third solution to this problem has involved a combination of the foregoing alternative solutions which combines the economic disadvantages of each of those alternatives.

Specific examples of each of these alternative solutions to this problem are described by U.S. 2,816,027, issued December 10, 1957, to Thomas H. Farrell et al. While describing in considerable detail these alternative solutions to the problem, that patent states that for certain purposes it is not necessary to apply a subbing to polystyrene sheeting before coating it with a photographic emulsion, especially where the photographic film is to be employed at comparatively high relative humidity. However, as a practical matter the application of a subbing coating to a polystyrene base sheet is essential in the production of photographic film intended for any normal usage.

It will be understood that the term "subbing" is used in this specification in its usually accepted sense to mean an intermediate film or coating on the surface of a base sheet or film which bonds a photographic gelatin-silver halide emulsion to the surface of the base sheet or film.

It is an object of this invention to provide a coating composition which is adapted for application to a polystyrene sheet or film in a single coating operation to form a subbing which will receive and firmly bond a conventional light-sensitive gelatin-silver halide coating to the polystyrene base sheet or film.

Other objects of this invention and its various advantageous features will become apparent from the detailed description which follows:

The coating composition in accordance with this inven-

tion comprises gelatin, nitrocellulose, acetic acid and phenol, a cresol, i.e. meta-, para- or ortho-cresol or a mixture of cresols dispersed in a suitable volatile solvent for nitrocellulose. It may contain about 0.5% to about 2.0%, by weight, of gelatin and preferably contain an amount within the range of about 0.75%, to about 1.5%, by weight, thereof. It may contain an amount of nitrocellulose within the range of about 0.25% to about 2.25%, by weight, and preferably within the range of about 0.75%, by weight, to about 1.5% by weight. It will contain an amount of phenol, a cresol or a mixture of cresols within the range of about 1.0% to about 5.0%, by weight, and preferably 2.0% to about 4.0%, by weight. The acetic acid content of the composition may be within the range of 1.5% to about 6.0%, by weight, and preferably will be within the range of about 2.0% to about 4.0%, by weight.

It is a well recognized fact that the strength of nitrocellulose varies with its viscosity characteristic with the strength falling off rapidly with the lower viscosity types. Despite this well-known fact, I have found in the case of a subbing film deposited from the composition of this invention, that its bonding strength increases when the lower viscosity types of nitrocellulose are used in the composition. A nitrocellulose having a viscosity characteristic of 15 seconds gives very poor adhesion between a photographic gelatin-silver halide emulsion film and a polystyrene surface. It is desirable to use a nitrocellulose in this coating composition which has a viscosity characteristic within the range of about 10 centipoises to about 5 seconds, and I prefer to use a nitrocellulose having a viscosity characteristic of within the range of about 10 centipoises to about 1/2 second. A 15 centipoise nitrocellulose has been found to give excellent results in this composition. The viscosity characteristic of a nitrocellulose of a type higher than 1/4 second may be measured by the standard falling ball method described by ASTM specification D301-50, while viscosity characteristics of 1/4 second or lower can be conveniently measured by the use of a capillary viscometer described for example on page 30 of the Hercules Nitrocellulose Handbook published by Hercules Powder Company. The nitrocellulose may be of the RS type or the SS type.

The phenol, the cresol, or the mixture of cresols in this composition is believed to increase the adhesion of the composition to the surface of the polystyrene sheet or film. It remains more or less completely in the coating film which remains after the evaporation of the volatile solvents. The acetic acid in the composition acts as a solvent for the gelatin in the composition and permits its solution in the anhydrous solvent for the nitrocellulose.

The polystyrene which is subbed by the use of the composition of this invention to form the base sheet or film of a photographic film is of the flexible type which may be produced by methods known in the art, U.S. Patent 2,074,285, issued March 16, 1937, to E. Studt et al., discloses a method for the production of such sheets. The polystyrene sheet or film may be of any desired thickness and will usually have a thickness within the range of about 0.002 inch to 0.020 inch.

The photographic silver halide emulsion which is supplied over the subbing on the polystyrene is of the conventional type. Typical photographic silver halide emulsions include silver chloride, silver bromide, silver iodide, silver bromiodide, silver chlorobromide and silver chlorobromiodide emulsions. The carrier for the silver halide is gelatin.

The coating composition in accordance with this in-

vention is specifically illustrated by the following example:

EXAMPLE 1

	Percent by wt.
Gelatin	0.93
Nitrocellulose (18 centipoise type)	1.52
Glacial acetic acid	3.54
Phenol	3.16
Methanol	75.00
Toluene	5.00
Butanol	8.50
Acetone	2.35

The composition illustrated by Example 1 may be applied to polystyrene film in an amount within the range of about 6.5 lbs. to about 16.5 lbs. (wet coating weight) per 1000 square feet.

As will be understood from the foregoing, the amounts of gelatin, of nitrocellulose, of glacial acetic acid and of phenol shown by Example 1 may be varied. In general, the ratio of nitrocellulose to gelatin should be within the range of about 0.5 to 1.5 parts by weight for each part by weight of gelatin. A cresol or a mixture of cresols can be substituted for phenol on a weight for weight basis. Example 2 gives ranges of proportions which may be used in the coating composition.

EXAMPLE 2

Ranges of proportions of ingredients for coating composition for subbing polystyrene film

	Percent by wt.
Gelatin	0.50-1.50
Nitrocellulose (viscosity within the range of 10 centipoises to 1/2 second)	0.25-2.25
Glacial acetic acid	1.50-6.00
Phenol or cresol	1.00-5.00
Volatile solvent mixture	The remainder

In the foregoing, various details have been given to fully explain the nature of this invention. However, it will be fully understood that various changes and modifications can be made in those details without departing from the spirit of this invention or the scope of the claims which follow.

I claim:

1. A coating composition consisting essentially of about 0.5%, by weight, to about 2.0%, by weight, of gelatin; about 0.5%, by weight, to about 2.25%, by weight, of nitrocellulose having a viscosity characteristic no higher than 5 seconds as measured by the standard method ASTM specification D301-50; about 1.5% by weight about 6.0%, by weight, of acetic acid; about 1.0%, by weight, to about 5.0%, by weight, of a material selected from the group consisting of phenol, ortho cresol, meta cresol, para cresol and mixtures of cresols; and a volatile organic solvent for the said nitrocellulose.

2. A coating composition consisting essentially of about 0.5%, by weight, to about 2.0%, by weight, of gelatin; about 0.5%, by weight, to about 2.25%, by weight, of nitrocellulose having a viscosity characteristic no higher than 1/2 second as measured by the standard method ASTM specification D301-50; about 1.5% by weight about 6.0%, by weight, of acetic acid; about 1.0%, by weight, to about 5.0%, by weight, of a material selected from the group consisting of phenol, ortho cresol, meta cresol, para cresol and mixtures of cresols; and a volatile organic solvent for the said nitrocellulose.

3. A coating composition consisting essentially of about 0.75%, by weight, to about 2.0%, by weight, of gelatin; about 0.75%, by weight, to about 1.5%, by weight, of nitrocellulose having a viscosity characteristic of no higher than 1/2 second as measured by the standard method ASTM specification D301-50; about 2.0%, by weight, of acetic acid; about 2.0%, by weight, to about 4.0%, by weight, of a material selected from the group consisting of phenol, ortho cresol, meta cresol, para cresol and mixtures of cresols; and a volatile solvent for the said nitrocellulose.

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