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PHOTOGRAPHIC FILM HAVING A POLYSTYRENE BASE

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4 Claims. (Cl. 96—87)

This invention relates to 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 gelatin-silver halide emulsion. Various solutions have been proposed for this problem. One proposed solution has been the application of an intermediate 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 the object of this invention to provide a photographic film, having a conventional light-sensitive silver halide gelatin coating, firmly bonded to a polystyrene base sheet.

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

The photographic film in accordance with this invention comprises a base sheet or film of polystyrene carrying on its surface an adherent subbing film comprising essentially gelatin, nitrocellulose having a viscosity characteristic of not more than 1840 centipoise and phenol, a cresol, or a mixture of cresols, which, in turn, carries a superimposed light-sensitive film of a gelatin-silver halide emulsion. In addition to a gelatin, nitrocellulose and phenol, the intermediate subbing layer may contain residual acetic acid. It may consist of about 22% to about 25%, by weight, of gelatin, about 22% to about 25% of nitrocellulose having a nitrogen content within the range of about 11.8% to about 12.2% and about 50% to about 55% of phenol, of a cresol, or a mixture of cresols.

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 this subbing film, that its bonding strength increases when the lower viscosity types of nitrocellulose are used in the composition. A nitrocellulose having a viscosity characteristic of 5520 centipoise gives very poor adhesion between a photographic gelatin-silver halide emulsion film and a polystyrene surface. It is desirable to use a nitrocellulose in the subbing which has a viscosity characteristic within the range of about 10 centipoises to about 1840 centipoise, and I prefer to use a nitrocellulose having a viscosity characteristic of within the range of about 10 centipoises to about 184 centipoise.

The composition from which this subbing is applied comprises gelatin, nitrocellulose, acetic acid and phenol, a cresol, i.e. ortho-, para- or meta-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 contains an amount within the range of about 0.75% to about 1.5%, by weight. 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, 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.

The nitrocellulose included in this composition may be one of the ester-solubule type having a nitrogen content within the range of about 11.8% to about 12.2%, or of the alcohol-soluble type having a nitrogen content within the range of about 10.9% to about 11.2% and as already noted, have a viscosity characteristic within the range of about 10 centipoise to about 5 seconds, and preferably within the range of about 10 centipoise to about 184 centipoise. A 15 centipoise nitrocellulose has been found to give excellent results in this composition.

The phenol or cresol 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 forms the base sheet or film of the photographic film in accordance with this invention 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 applied 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 chloro-

bromiodide emulsions. The carrier for the silver halide is gelatin.

The coating composition from which the intermediate subbing film is applied is specifically illustrated by the following example:

EXAMPLE 1

Coating Composition for Subbing Polystyrene Film

	Percent by weight
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 weight
Gelatin	0.50–1.50
Nitrocellulose (viscosity within the range of 10 centipoises to 184 centipoises)	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 within departing from the spirit of this invention or the scope of the claims which follow.

I claim:

1. A photographic film comprising a flexible polystyrene base sheet carrying on its surface an adherent layer comprising gelatin, nitrocellulose having a viscosity characteristic no higher than 1840 centipoise and a material selected from the group consisting of phenol, a cresol and mixtures of cresols which, in turn, carries on its surface a layer of a photographic silver halide emulsion.

2. A photographic film comprising a flexible polystyrene base sheet carrying on its surface an adherent layer comprising gelatin, nitrocellulose having a viscosity characteristic no higher than 184 centipoise and a material selected from the group consisting of phenol, a cresol and mixtures of cresols which, in turn, carries on its surface a layer of a photographic silver halide emulsion.

3. A photographic film comprising a flexible, polystyrene sheet carrying on its surface an adherent layer comprising about 22% to about 25% of gelatin, about 22% to about 25% of nitrocellulose having a viscosity characteristic of not higher than 1840 centipoise and about 50% to about 55% of a material selected from the group consisting of phenol, a cresol and mixtures of cresols which, in turn, carries on its surface a layer of a photographic silver halide emulsion.

4. A photographic film comprising a flexible, polystyrene sheet carrying on its surface an adherent layer comprising about 22% to about 25% of gelatin, about 22% to about 25% of nitrocellulose having a viscosity characteristic of not higher than about 184 centipoise and about 50% to about 55% of a material selected from the group consisting of phenol, a cresol and mixtures of cresols which, in turn, carries on its surface a layer of a photographic silver-halide emulsion.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,042,523 July 3, 1962

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It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, lines 5 and 22, before "1840", each occurrence, insert -- about --.

Signed and sealed this 23rd day of October 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents