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[54] ANTI-STATIC COATING FOR PHOTOGRAPHIC EMULSION LAYERS

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[51] **Int. Cl.**.....**G03c 1/76**

[58] **Field of Search** .....96/114.2, 87 A; 117/201

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[57] **ABSTRACT**

This application describes a method of improving the surface electrical conductivity of photographic material which is characterized in that it comprises coating on to the surface of the photographic material an aqueous solution of kappa-carrageenan and a sufficient amount of a salt of potassium or ammonium to cause the kappa-carrageenan to gel, allowing the coated layer to gel and drying the photographic material.

6 Claims, No Drawings

ANTI-STATIC COATING FOR PHOTOGRAPHIC EMULSION LAYERS

This invention relates to colloid silver halide photographic film material provided with an antistatic layer and to the production of such film material.

It is known that photographic film material exhibits a tendency to pick up electrostatic charges during the course of its manufacture and also during its use. When an electrostatically charged film is discharged so called "static marks" are produced. These marks show as areas of local over-exposure on the developed film. It is possible to reduce the tendency of photographic film to pick up electrostatic charges by the provision of a layer which has a relatively high electroconductivity. Any electrostatic charge picked up by a film having such a layer rapidly leaks to earth without causing a discharge.

It is the object of the present invention to provide a method of improving the surface conductivity of photographic material.

According to the present invention there is provided a method of improving the surface electrical conductivity of photographic film material which comprises coating on to a surface of the photographic material an aqueous solution of kappa-carrageenan and a sufficient amount of a salt of potassium or ammonium to cause the kappa-carrageenan to gel, allowing the coated layer to gel and then drying the photographic material.

Carrageenan is a natural gum derived from seaweed. It usually exists as a mixture of kappa- and lambda-carrageenan sometimes together with minor proportions of other carrageenans. Carrageenan is a polygalactose and the difference between the kappa and lambda varieties lies in structural differences in the complex chains. However kappa- and lambda-carrageenan can readily be distinguished by the fact that kappa-carrageenan is precipitated from an aqueous solution by potassium salts while lambda-carrageenan is not so precipitated. However in the process of the present invention the kappa-carrageenan used need not be pure kappa-carrageenan and a proportion of lambda-carrageenan and possibly minor amounts of other carrageenans may also be present. Therefore the term kappa-carrageenan as used herein refers to carrageenan which comprises from 70 to 100 percent kappa-carrageenan.

For the same strength of solution in water kappa-carrageenan solutions are more viscous than gelatin solutions and thus aqueous solutions of kappa-carrageenan stronger than 1 percent by weight tend to give rise to difficulty in coating. On the other hand an aqueous solution of kappa-carrageenan which is weaker than 0.2 percent by weight tends to be difficult to gel. Thus the preferred concentration of kappa-carrageenan for use in the present invention is 0.2 to 1 percent by weight and preferably 0.4 to 0.6 percent by weight.

The minimum amount of a salt of potassium or ammonium required to cause the kappa-carrageenan to gel is approximately 0.05 percent in the aqueous coating solution. However a too strong concentration of the salt in the coating solution causes precipitation of the carrageenan (as hereinbefore mentioned). In such cases, on drying, a layer is formed which has a relatively low conductivity. For example 0.5 percent by weight of potassium chloride in an aqueous kappa-carrageenan solution causes precipitation of the kappa-carrageenan.

Furthermore the higher the concentration of potassium or ammonium salt present the higher the setting temperature of the gel. In every case the coating solution should be such that it may be coated at a temperature below the melting point of the colloid of the photographic emulsion while itself remaining ungelled. Thus the preferred concentration of a salt of potassium or ammonium in the coating solution used in the process of the present invention is from 0.05 to 0.2 percent by weight.

The present invention includes photographic material which comprises a support base having on one side a colloid silver halide layer and on the other side a layer of gelled kappa-carrageenan, or photographic material wherein the layer of gelled kappa-carrageenan is on the same side as the colloid silver halide layer either coated on a supercoat layer on the colloid silver halide layer or preferably, coated directly as a supercoat layer on the colloid silver halide layer. Preferably, in the case of X-ray film material which comprises a colloid silver halide layer on each side of the support base there is present a gelled kappa-carrageenan layer on each colloid silver halide layer as the supercoat layer.

The following example will serve to illustrate the invention.

EXAMPLE

Strips of X-ray film emulsion coated on each side of a base support were coated on each emulsion layer by the process of the present invention. There was formed a supercoat layer on each side of the photographic material which comprised a gelled layer of kappa-carrageenan. The actual coating solutions used in each case are shown in the table which follows. These strips were compared to a similar strip of X-ray film material which had on each side a gelatin supercoat.

Two tests were carried out on each of the strips. In one test the film strips were brought to equilibrium at a relative humidity of 20 percent and their resistivities at this humidity were measured under an applied potential of 10kV. The results of this test are shown in the table as set forth below under the heading Log R.

In another test, also carried out at 20 percent R.H. the propensity of the film strips to static formation was assessed. Strips were charged by being passed between rubber rollers to create a static charge which was measured by a juxtaposed field meter. An indication of how quickly the applied charge was dissipated was obtained by measuring the field again after 20 seconds. The results are shown also in the table which follows.

The kappa-carrageenan used in the foregoing example was supplied by Marine Colloids Inc., and comprises 83 percent kappa and 17 percent lambda forms.

TABLE

Supercoat Solution Colloid	Salt	Setting Temps. °F.	Log Resistivity (OHM/SQ)	Electrical tests Field V/Cm. Peak	20 secs.
2% Gelatin	—	58	13.9	390	360
0.5% kappa-carrageenan	0.05% KCl	64	—	390	170
0.5% kappa-carrageenan	0.1% KCl	76	12.6	270	50
0.5% kappa-carrageenan	0.15% KCl	—	—	90	40
0.5% kappa-carrageenan	0.2% KCl	93	11.1	15	10

Reduction of propensity to static and decreased resistivity is thus in evidence with all the mixtures of salt and carrageenan. The potassium salt however, is especially efficacious, and at the 0.2 percent level has substantially inhibited formation of static.

The new supercoats have substantially no effect on the initial photographic properties of the emulsion.

I claim as my invention:

1. A method of improving the surface electrical conductivity of photographic material comprising a film base and at least one silver halide emulsion layer, said method comprising the steps of: coating on to the surface of the photographic material an aqueous solution of kappa-carrageenan and at least 0.05 percent by weight, based on the weight of said solution, of a chloride of potassium or ammonium, the amount of said chloride being sufficient to cause the kappa-carrageenan to gel, allowing the coated layer to gel and drying the photographic material so as to provide thereon an antistatic coating consisting essentially of the gelled kappa-carrageenan and said chloride.

2. A method according to claim 1 wherein concentration of kappa-carrageenan in the aqueous solution is from 0.2 to 1 percent by weight of said solution.

3. A method according to claim 1 wherein the concentration of chloride of potassium or ammonium in the coating solution is from 0.05 to 0.2 percent by weight.

4. A method according to claim 1 wherein the photographic material comprises a film base carrying at least one photographic silver halide emulsion layer and the said aqueous solution is applied to the surface of the outermost emulsion layer.

5. A method according to claim 1 wherein the photographic material comprises a film base carrying on one side only thereof at least one photographic silver halide emulsion layer and the said aqueous solution is applied to the other side of the film base.

6. Photographic material comprising a film base, at least one silver halide emulsion layer and a dried layer of a gelled kappa-carrageenan and potassium or ammonium chloride.

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