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(54) **Improved imaging surfaces.**

(57) A photographic element comprising at least one silver halide photographic emulsion in a hydrophilic colloidal binder on a substrate and a surface matting layer over said at least one emulsion, said matting agent layer comprising a binder having at least two different types of non-developmentally disolvable particles therein, one type of particle comprising a matting agent having an average particle size of between 1 and 10 microns in a coating weight of between 0.015 and 0.15 g/m², and the second type of particle comprising buoying particles having an average particle size of between 0.20 and 0.75 microns in a coating weight of between 0.2 and 0.7 g/m².

The combinations of particles having different sizes are used to improve drawdown, reduce the starry night effect, and maintain the sensitometric quality of photographic film materials.

EP 0 282 171 A2

IMPROVED IMAGING SURFACES

The present invention relates to photographic elements and particularly to photographic elements having surface roughening agents in their topcoats. Displacement of silver halide grains by matting agents is prevented and image quality improved.

Matting agents are commonly applied to the top layer in photographic elements for a number of purposes. The matting agents can improve the ability of the surface to accept writing, adjust the coefficient of friction for mechanical handling of the element, reduce Newton's rings formation during printing and enlarging, and create air pockets to facilitate drawdown of layers against the element in a vacuum system.

A significant problem has often been encountered in the use of surface matting agents in photographic elements. This problem is referred to as the "starry night" effect in the photographic trade. The effect is small areas of greatly diminished optical density. On a solid black image, the defect looks very much like a starry night, with many white dots on a black background. This effect has been determined to result from physical effects occurring during manufacture of the film. As noted in U.S. Patent No. 4,172,731, modern production of photographic elements coat more than one layer at a time. Drying of the last coated layers, the last of which contains matting agents, generates the starry night effect. As the layers dry, they shrink. The bottom portion of matting agents is forced into adjacent layers (e.g., silver halide emulsion layers) during this drying period. The movement of the matting particles into emulsion layers forces the silver halide grains out of small areas. As there is no silver halide in these areas, no optical density can be provided upon exposure and development. It is the absence of silver halide grains and the absence of developable optical density that show up as the starry night effect.

U.S. Patent No. 4,172,731 attempts to solve the starry night problem by using pigmented polymeric particles as the matting agent. The pigments are to be of the same color as the image to be formed in the adjacent emulsion layer. These agents merely mask the effect and do not change the undesirable distribution of silver halide in the adjacent layer.

U.S. Patent No. 4,232,117 does not address the problem of the starry night effect but uses both a matting agent of 1 to 5 microns and colloidal silica of 7 to 120 microns for antiadhesive properties.

U.S. Patent No. 3,411,907 combines two different types of matting agents, a soft and a hard matting agent, at least 90% by weight of said hard particle matting agents having a diameter of at least about 1 micron and at least 40% by weight of said soft matting agents having a diameter in excess of 4 microns.

U.S. Patent No. 4,343,873 discloses the use of a light-scattering topcoat layer containing both light-scattering particles having dimensions between 0.32 and 1.9 microns and matting agent particles having average diameters between 2 and 5 microns. The light-scattering particles are present in a concentration of from 0.7 to 10 g/m² in the coating and must be dissolved from the element during development.

Radiation sensitive photographic elements are provided with an improved matte layer construction which provides a short contact vacuum drawdown time, acceptable starry night effect levels, good surface friction properties, and acceptable haze. Two different size non-developmentally dissolvable particle components in critical weight proportions are used. The larger particles provide the matte finish and the smaller particles buoy the larger particles in the topcoat layer, reducing the starry night effect.

Radiation sensitive silver halide photographic elements are provided with an improved surface roughening or matte composition on their outer face. The outer face is a surface of the photographic element over a silver halide emulsion layer, usually the surface furthest from the backing layer. The photographic element may be a black-and-white photographic element or a color photographic element and may be sensitive to any actinic portion of the electromagnetic spectrum such as the ultraviolet, visible or infrared regions.

The surface roughening topcoat comprises a hydrophilic colloidal binder containing two sets of particles having different size distributions and concentrations. One of the sets of particles is a matting agent having average particle diameters of greater than 1.0 micron and less than 10 micron in a coating weight of greater than 0.015 g/m² and less than 0.15 g/m². The other set of particles comprises a buoying agent having an average particle size of between 0.20 and 0.75 microns in a coating weight of between 0.2 and 0.7 g/m² or 1.0 g/m². Both particles must be non-dissolvable during development to provide the final characteristics to the product. The buoying particles may even be separately included in the emulsion layer. Their size will not create starry night effects in the image, but they still offer some support against penetration by the larger particles into the emulsion layer.

The particles may be selected from the same or different materials, may be hard or soft, colored or colorless (preferred), and organic or inorganic. They should be light insensitive in that they should not be silver halide particles which are developable to form a visual image. The particles may not be soluble during the development process. If the smaller particles were soluble, the large particles could "fall" during

development and force their way into lower layers during drying and rethinning of the topcoat layer during drying. The particles may be selected from amongst inorganic particles such as barium sulfate, silica, calcium, carbonate, baria, titania, calcium sulfate, barium carbonate, and the like, or organic particles such as cellulose esters, cellulose ethers, acrylic or methacrylic resins (such as polymers or copolymers or
 5 methacrylate, acrylic acid, methacrylic acid, n-butylmethacrylate, etc.), polyvinyl resins, polymers and copolymers of ethylenically unsaturated resins such as styrene, butadiene, and the like, polycarbonates, etc.

The size range of the particles and their coating weights are critical to the practice of the present invention. If the small particle sizes are less than 0.20 microns or if their coating weight is less than 0.2
 10 g/m², there will be no buoying effect. If the size of the small particles exceeds an average of 0.75 microns, the particles will contribute to the starry night effect. If the coating weight of small particles exceeds 0.7 g/m², increased haze will be produced in the photographic element. The proportions and size of the larger particles are important in providing the matte finish and minimizing the starry night effect.

Any of the various types of photographic silver halide emulsions may be used in the practice of the
 15 present invention. Silver chloride, silver bromide, silver iodobromide, silver chlorobromide, silver chlorobromide and mixtures thereof may be used for example. Any configuration of grains, cubic or orthorhombic, hexagonal, epitaxial; lamellar, tabular or mixtures thereof may be used. These emulsions are prepared by any of the well-known procedures, e.g., single or double jet emulsions as described by Wietz et al., U.S. Patent 2,222,264, Illingsworth, U.S. Patent 3,320,069, McBride, U.S. Patent 3,271,157 and U.S.
 20 Patents 4,425,425 and 4,425,426.

The silver halide emulsions of this invention can be unwashed or washed to remove soluble salts. In the latter case the soluble salts can be removed by chill-setting and leaching or the emulsion can be coagulation washed e.g., by the procedures described in Hewitson et al., U.S. Patent 2,618,556; Yutzy et al., U.S. Patent 2,614,928; Yackel, U.S. Patent 2,565,418; Hart et al., U.S. Patent 3,241,969; and Waller et al.,
 25 U.S. Patent 2,489,341.

Photographic emulsions can be sensitized with chemical sensitizers, such as with reducing agents; sulfur, selenium or tellurium compounds; gold, platinum or palladium compounds; or combinations of these. Suitable chemical sensitization procedures are described in Shepard, U.S. Patent 1,623,499; Waller, U.S. Patent 2,399,083; McVeigh, U.S. Patent 3,297,447; and Dunn, U.S. Patent 3,297,446.

The silver halide emulsions of this invention can contain speed increasing compounds such as polyalkylene glycols, cationic surface active agents and thioethers or combinations of these as described in
 30 Piper, U.S. Patent 2,886,437; Chechak, U.S. Patent 3,046,134; Carroll et al., U.S. Patent 2,944,900; and Goffe, U.S. Patent 3,294,540.

Silver halide emulsions can be protected against the production of fog and can be stabilized against
 35 loss of sensitivity during keeping. Suitable antifoggants and stabilizers which can be used alone or in combination, include the thiazolium salts described in Staud, U.S. Patent 2,131,038 and Allen U.S. Patent 2,694,716; the azaindenes described in Piper, U.S. Patent 2,886,437 and Heimbach, U.S. Patent 2,444,605; the mercury salts described in Allen, U.S. Patent 2,728,663; the urazoles described in Anderson, U.S. Patent 3,287,135; the sulfocatechols described in Kennard, U.S. Patent 3,235,652; the oximes described in
 40 Carrol et al., British Patent 623,448; nitron; nitroindazoles; the polyvalent metal salts described in Jones, U.S. Patent 2,839,405; the thiuronium salts described in Herz, U.S. Patent 3,220,839; and the palladium, platinum and gold salts described in Trivelli, U.S. Patent 2,566,263 and Damschroder, U.S. Patent 2,597,915.

Silver halide can be dispersed in colloids that can be hardened by various organic or inorganic
 45 hardeners, alone or in combination, such as the aldehydes, and blocked aldehydes, ketones, carboxylic and carbonic acid derivatives, sulfonate esters, sulfonyl halides and vinyl sulfones, active halogen compounds, epoxy compounds, aziridines, active olefins, isocyanates, carbodiimides, mixed function hardeners and polymeric hardeners such as oxidized polysaccharides e.g., dialdehyde starch, oxyguargum, etc.

Photographic emulsions can contain various colloids alone or in combination as vehicles or binding
 50 agents. Suitable hydrophilic materials include both naturally-occurring substances such as proteins, for example, gelatin, gelatin derivatives (e.g., phthalated gelatin), cellulose derivatives, polysaccharides such as dextran, gum arabic and the like; and synthetic polymeric substances such as water soluble polyvinyl compounds, e.g., poly(vinylpyrrolidone) acrylamide polymers or other synthetic polymeric compounds such as dispersed vinyl compounds in latex form, and particularly those which increase the dimensional stability
 55 of the photographic materials. Suitable synthetic polymers include those described, for example, in U.S. Patents 3,142,568 of Nottorf; 3,193,386 of White; 3,062,674 of Houck, Smith and Yudelson; 3,220,844 of Houck, Smith and Yudelson; Ream and Fowler, 3,287,289; and Dykstra, U.S. Patent 3,411,911; particularly effective are those water-insoluble polymers of alkyl acrylates and methacrylates, acrylic acid, sulfoalkyl

acrylates or methacrylates, those which have cross linking sites which facilitate hardening or curing and those having recurring sulfobetaine units as described in Canadian Patent 774,054.

Emulsions in accordance with this invention can be used in photographic elements which contain antistatic or conducting layers, such as layers that comprise soluble salts, e.g., chlorides, nitrates, etc., evaporated metal layers, ionic polymers such as those described in Minsk, U.S. Patents 2,861,056 and 3,206,312 or insoluble inorganic salts such as those described in Trevoy, U.S. Patent 3,428,451.

Photographic emulsions can be coated on a wide variety of supports. Typical supports include polyester film, subbed polyester film, poly(ethylene terephthalate) film, cellulose nitrate film, cellulose ester film, poly(vinyl acetal) film, polycarbonate film and related or resinous materials, as well as glass, paper, metal and the like. Typically, a flexible support is employed, especially a paper support, which can be partially acetylated or coated with baryta and/or an alpha-olefin polymer, particularly a polymer of an alpha-olefin containing 2 to 10 carbon atoms such as polyethylene, polypropylene, ethylenebutene copolymers and the like.

Emulsions of the invention can contain plasticizers and lubricants such as polyalcohols, e.g., glycerin and diols of the type described in Milton, U.S. Patent 2,960,404; fatty acids or esters such as those described in Robins, U.S. Patent 2,588,765 and Duane, U.S. Patent 3,121,060; and silicone resins such as those described in DuPont British Patent 955,061.

The emulsions as described herein can contain surfactants such as saponin, anionic compounds such as the alkylarylsulfonates described in Baldsiefen, U.S. Patent 2,600,831 fluorinated surfactants, and amphoteric compounds such as those described in Ben-Ezra, U.S. Patent 3,133,816.

Photographic elements as described herein can contain matting agents such as starch, titanium dioxide, zinc oxide, silica, polymeric beads including beads of the type described in Jelley et al., U.S. Patent 2,992,101 and Lynn, U.S. Patent 2,701,245.

Emulsions of the invention can be utilized in photographic elements which contain brightening agents including stilbene, triazine, oxazole and coumarin brightening agents. Water soluble brightening agents can be used such as those described in Albers et al., German Patent 972,067 and McFall et al., U.S. Patent 2,933,390 or dispersions of brighteners can be used such as those described in Jansen, German Patent 1,150,274 and Oetiker et al., U.S. Patent 3,406,070.

Photographic elements containing emulsion layers according to the present invention can be used in photographic elements which contain light absorbing materials and filter dyes such as those described in Sawdey, U.S. Patent 3,253,921; Gaspar, U.S. Patent 2,274,782; Carroll et al., U.S. Patent 2,527,583 and Van Campen, U.S. Patent 2,956,879. If desired, the dyes can be mordanted, for example, as described in Milton and Jones, U.S. Patent 3,282,699.

Contrast enhancing additives such as hydrazines, rhodium, iridium and combinations thereof are also useful.

Photographic emulsions of this invention can be coated by various coating procedures including dip coating, air knife coating, curtain coating, or extrusion coating using hoppers of the type described in Beguin, U.S. Patent 2,681,294. If desired, two or more layers may be coated simultaneously by the procedures described in Russell, U.S. Patent 2,761,791 and Wynn British Patent 837,095.

The couplers may be present either directly bound by a hydrophilic colloid or carried in a high temperature boiling organic solvent which is then dispersed within a hydrophilic colloid. The colloid may be partially hardened or fully hardened by any of the variously known photographic hardeners. Such hardeners are free aldehydes (U.S. Patent 3,232,764), aldehyde releasing compounds (U.S. Patent 2,870,013 and 3,819,608), s-triazines and diazines (U.S. Patent 3,325,287 and 3,992,366), aziridines (U.S. Patent 3,271,175), vinylsulfones (U.S. Patent 3,490,911), carbodiimides, and the like may be used.

The silver halide photographic elements can be used to form dye images therein through the selective formation of dyes. The photographic elements described above for forming silver images can be used to form dye images by employing developers containing dye image formers, such as color couplers, as illustrated by J.K. Patent No. 478,984; Yager et al., U.S. Patent No. 3,113,864; Vittum et al., U.S. Patent Nos. 3,002,836, 2,271,238 and 2,362,598. Schwan et al. U.S. Patent No. 2,950,970; Carroll et al., U.S. Patent No. 2,592,243; Porter et al., U.S. Patent Nos. 2,343,703, 2,376,380 and 2,369,489; Spath U.K. Patent No. 886,723 and U.S. Patent No. 2,899,306; Tuite U.S. Patent No. 3,152,896 and Mannes et al., U.S. Patent Nos. 2,115,394, 2,252,718 and 2,108,602, and Pilato U.S. Patent No. 3,547,650. In this form the developer contains a color-developing agent (e.g., a primary aromatic amine which in its oxidized form is capable of reacting with the coupler (coupling) to form the image dye. Also, instant self-developing diffusion transfer film can be used as well as photothermographic color film or paper using silver halide in catalytic proximity to reducible silver sources and leuco dyes.

The dye-forming couplers can be incorporated in the photographic elements, as illustrated by

Schneider et al. Die Chemie, Vol. 57, 1944, p. 133, Mannes et al. U.S. Patent No. 2,304,940, Martinez U.S. Patent No. 2,269,158, Jelley et al. U.S. Patent No. 2,322,027, Frolich et al. U.S. Patent No. 2,376,679, Fierke et al. U.S. Patent No. 2,801,171, Smith U.S. Patent No. 3,748,141, Tong U.S. Patent No. 2,772,163, Thirtle et al. U.S. Patent No. 2,835,579, Sawdey et al. U.S. Patent No. 2,533,514, Peterson U.S. Patent No. 2,353,754, Seidel U.S. Patent No. 3,409,435 and Chen Research Disclosure, Vol. 159, July 1977, Item 15930. The dye-forming couplers can be incorporated in different amounts to achieve differing photographic effects. For example, U.K. Patent No. 923,045 and Kumai et al. U.S. Patent No. 3,843,369 teach limiting the concentration of coupler in relation to the silver coverage to less than normally employed amounts in faster and intermediate speed emulsion layers.

The dye-forming couplers are commonly chosen to form subtractive primary (i.e., yellow, magenta and cyan) image dyes and are non-diffusible, colorless couplers, such as two and four equivalent couplers of the open chain ketomethylene, pyrazolone, pyrazolone, pyrazolotriazole, pyrazolobenzimidazole, phenol and naphthol type hydrophobically ballasted for incorporation in high-boiling organic (coupler) solvents. Such couplers are illustrated by Salminen et al. U.S. Patent Nos. 2,423,730, 2,772,162, 2,895,826, 2,710,803, 2,407,207, 3,737,316 and 2,367,531; Loria et al. U.S. Patent Nos. 2,772,161, 2,600,788, 3,006,759, 3,214,437 and 3,253,924; McCrossen et al., U.S. Patent No. 2,875,057; Bush et al. U.S. Patent No. 2,908,573; Gledhill et al. U.S. Patent No. 3,034,892; Weissberger et al. U.S. Patent Nos. 2,474,293, 2,407,210, 3,062,653, 3,265,506 and 3,384,657; Porter et al. U.S. Patent No. 2,343,703; Greenhalgh et al. U.S. Patent No. 3,127,269; Feniak et al., U.S. Patent 2,865,748, 2,933,391 and 2,865,751; Bailey et al. U.S. Patent 3,725,067; Beavers et al. U.S. Patent No. 3,758,308; Lau U.S. Patent No. 3,779,763; Fernandez U.S. Patent No. 3,785,829; U.K. Patent No. 969,921; U.K. Patent No. 1,241,069; U.K. Patent No. 1,011,940, Vanden Eynde et al. U.S. Patent No. 3,762,921; Beavers U.S. Patent No. 2,983,608; Loria U.S. Patent Nos. 3,311,476, 3,408,194, 3,458,315, 3,447,928, 3,476,563; Cressman et al. U.S. Patent No. 3,419,390; Young U.S. Patent No. 3,419,391; Lestina U.S. Patent No. 3,519,429; U.K. Patent No. 975,928; U.K. Patent No. 1,111,554; Jaeken U.S. Patent No. 3,222,176 and Canadian Patent No. 726,651; Schulte et al. U.K. Patent No. 1,248,924 and Whitmore et al. U.S. Patent No. 3,227,550. Dye-forming couplers of differing reaction rates in single or separate layers can be employed to achieve desired effects for specific photographic applications.

The dye-forming couplers upon coupling can release photographically useful fragments, such as development inhibitors or accelerators, bleach accelerators, developing agents, silver halide solvents, toners, hardeners, fogging agents, antifoggants, competing couplers, chemical or spectral sensitizers and desensitizers. Development inhibitor-releasing (DIR) couplers are illustrated by Whitmore et al. U.S. Patent No. 3,148,062; Barr et al. U.S. Patent No. 3,227,554; Barr U.S. Patent No. 3,733,201; Sawdey U.S. Patent No. 3,617,291; Groet et al. U.S. Patent No. 3,703,375; Abbott et al., U.S. Patent No. 3,615,506; Weissberger et al. U.S. Patent No. 3,265,506; Seymour U.S. Patent No. 3,620,745; Marx et al. U.S. Patent No. 3,632,345; Mader et al. U.S. Patent No. 3,869,291; U.K. Patent No. 1,201,110; Oishi et al. U.S. Patent No. 3,642,485; Verbrugghe, U.K. Patent No. 1,236,767; Fujiwhara et al. U.S. Patent No. 3,770,435 and Matsuo et al. U.S. Patent No. 3,808,945. Dye-forming couplers and non-dye-forming compounds which upon coupling release a variety of photographically useful groups are described by Lau U.S. Patent No. 4,248,962. DIR compounds which do not form dye upon reaction with oxidized color-developing agents can be employed, as illustrated by Fujiwhara et al. German OLS 2,529,350 and U.S. Patent Nos. 3,928,041, 3,958,993 and 3,961,959; Odenwalder et al. German OLS No. 2,448,063; Tanaka et al. German OLS No. 2,610,546; Kikuchi et al. U.S. Patent No. 4,049,455 and Credner et al. U.S. Patent No. 4,052,213. DIR compounds which oxidatively cleave can be employed, as illustrated by Porter et al. U.S. Patent No. 3,379,529; Green et al. U.S. Patent no. 3,043,690; Barr U.S. Patent No. 3,364,022; Duennebier et al. U.S. Patent No. 3,297,445 and Rees et al. U.S. Patent No. 3,287,129. Silver halide emulsions which are relatively light insensitive, such as Lipmann emulsions, having been utilized as interlayers and overcoat layers to prevent or control the migration of development inhibitor fragments as described in Shiba et al. U.S. Patent No. 3,892,572.

The photographic elements can incorporate colored dye-forming couplers, such as those employed to form integral masks for negative color images, as illustrated by Hanson U.S. Patent No. 2,449,966; Glass et al. U.S. Patent No. 2,521,908; Gledhill et al. U.S. Patent No. 3,034,892; Loria U.S. Patent No. 3,476,563; Lestina U.S. Patent No. 3,519,429; Friedman U.S. Patent No. 2,543,691; Puschel et al. U.S. Patent No. 3,028,238; Menzel et al. U.S. Patent No. 3,061,432 and Greenhalgh U.K. Patent No. 1,035,959, and/or competing couplers, as illustrated by Murin et al. U.S. Patent No. 3,876,428; Sakamoto et al. U.S. Patent No. 3,580,722; Puschel U.S. Patent No. 2,998,314; Whitmore U.S. Patent No. 2,808,329; Salminen U.S. Patent No. 2,742,832 and Weller et al. U.S. Patent No. 2,689,793.

The photographic elements can include image dye stabilizers. Such image dye stabilizers are illustrated by U.K. Patent No. 1,326,889; Lestina et al. U.S. Patent Nos. 3,432,300 and 3,698,909; Stern et al. U.S. Patent No. 3,574,627; Brannock et al. U.S. Patent No. 3,573,050; Arai et al. U.S. Patent No. 3,764,337 and

Smith et al. U.S. Patent No. 4,042,394.

These types of imaging systems are well known in the art. Detailed discussions of various dye transfer, diffusion processes may be found for example in "A Fundamentally New Imaging Technology for Instant Photography", W. T. Harison, Jr., Photographic Science and Engineering, Vol. 20, No. 4, July/August 1976, and Neblette's Handbook of Photography and Reprography, Materials, Processes and Systems, 7th Edition, John M. Stunge, van Nostrand Reinhold Company, N.Y., 1977, pp. 324-330 and 126. Detailed discussion of dye-bleach color imaging systems are found for example in The Reproduction of Colour, 3rd Ed., R. W. G. Hunt, Fountain Press, London, England 1975 pp. 325-330; and The Theory of the Photographic Process, 4th Ed., Mees and James, Macmillan Publishing Co., Inc., N.Y., 1977 pp. 363-366. Pages 366-372 of Mees and James, supra. also discuss dye-transfer processes in great detail. Leuco dye oxidation in silver halide systems are disclosed in such literature as U.S. Pat. Nos. 4,460,681, 4,374,821 and 4,021,240.

Other conventional photographic addenda such as coating aids, antistatic agents, acutance dyes, antihalation dyes and layers, antifoggants, latent image stabilizers, antikinking agents, and the like may also be present.

The following examples will further illustrate the practice of the present invention.

The measurement of haze in the examples and in the practice of the present invention is done according to ASTM D1003-61 (Reapproved 1977). Percent haze is determined as

$$\frac{T_d}{T_t} \times 100$$

in which T_d is diffuse transmittance and T_t is the total transmittance.

Examples 1-5

A photographic emulsion comprising 0.15 micron cubic chlorobromide grains (64/36, Cl/Br) in a gelatin binder were coated on primed and subbed polyethyleneterephthalate base at a silver coating weight of 4.0 g/m². Five different gelatin topcoats were applied to samples of this coated emulsion to evaluate the effects of particle sizes and coating weights on starry night, haze and drawdown time. The film was exposed and conventionally developed and sensitometry readings on those three parameters were taken. The results are shown in Table 1. 2.35 micron silica was used as the large particles (LP) and 0.5 micron polymethylmethacrylate was used as the small particles (SP).

		LP	SP			Drawdown
	Example	(g/m ²)	(g/m ²)	Starry Night	Haze	(seconds)
40	1	0.011	--	4.3	3.5	16.0
	2	0.022	0.215	4	7	10
	3	0.022	0.334	3	7.7	10
	4	0.044	--	5.3	10	11
45	5	0.077	0.43	2.3	15	4.7

The values for starry night are interpretable as meaning that 6 is unacceptable, 5 is poor, 4 is marginally acceptable, 3 is very good and 2 is excellent. Haze values up to a maximum of 15 are acceptable.

The data show that by combining small particles with the matting agent, larger levels of matting agent may be used to improve drawdown times without degradation of the starry night effect. In fact, higher levels of matting agents may be used with lower starry night effects present.

Claims

1. A photographic element comprising at least one silver halide photographic emulsion in a hydrophilic colloidal binder on a substrate and a surface matting layer over said at least one emulsion, said matting agent layer comprising a binder having at least two different types of non-developmentally dissolvable particles therein, one type of particle comprising a matting agent having an average particle size of between 1 and 10 microns in a coating weight of between 0.015 and 0.15 g/m², and the second type of particle comprising buoying particles having an average particle size of between 0.20 and 0.75 microns in a coating weight of between 0.2 and 0.7 g/m².
2. The element of claim 1 wherein said buoying particles have an average size between 0.3 and 0.6 microns.
3. The element of claim 1 wherein said buoying particles comprise an organic polymeric material.
4. The element of claim 2 wherein said buoying particles comprise an organic polymeric material.
5. The element of claims 1-4 wherein said matting agents comprise an inorganic particle.
6. The element of claims 1-4 wherein said matting agents have an average particle size of between 2 and 7 microns.
7. The element of claims 1-4 wherein said buoying particles are present in a coating weight of between 0.2 and 1.0 g/m².
8. The element of claim 5 wherein said buoying particles are present in a coating weight of between 0.2 and 1.0 g/m².
9. The element of claim 6 wherein said buoying particles are present in a coating weight of between 0.2 and 1.0 g/m².
10. A photographic element comprising at least one silver halide photographic emulsion in a hydrophilic colloidal binder on a substrate and a surface matting layer over said at least one emulsion in an adjacent layer, said matting agent layer comprising a binder having at least one non-developmentally dissolvable particle comprising a matting agent having an average particle size of between 1 and 10 microns in a coating weight of between 0.015 and 0.15 g/m², and a second type of particle is present in said emulsion comprising buoying particles having an average particle size of between 0.20 and 0.75 microns in a coating weight of between 0.2 and 0.7 g/m².