data release

KODAK High Resolution Film (ESTAR Thick Base) SO-343

KODAK High Resolution Film (ESTAR Thick Base) SO-343, like KODAK High Resolution Plates, is useful for producing scales, reticles, encoders, and other examples of micrographic imagery. Its characteristics make it ideal for exacting applications of high-resolution photography that require a film having the dimensional stability and high contrast of KODAK Reproduction Film 4566 (ESTAR Thick Base) but also having higher resolution. SO-343 Film can be used for recording or duplicating microimages at reductions from original size of 100X or more. It can also be used for mask generation in microelectronics applications, either in first reductions from original artwork or in masks for single-layer devices, where the dimensional stability of glass plates is not essential. In all of these applications, lenses of extremely high quality are required to make full use of the ultrahigh resolving power of the film. SO-343 Film is also useful for recording holograms made with argon lasers and for contact microradiography.

FEATURES

- Extremely slow orthochromatic emulsion
- Extremely high contrast
- Ultrahigh resolving power
- Microfine granularity
- ESTAR Thick Base (a tough, dimensionally stable polyester support of 7-mil thickness)
- Dyed-gel backing for suppression of halation and curl

USES

- Production of scales and reticles
- Microfilmed records
- Transparencies for printed-circuit boards
- Contact microradiography
- Transparencies for chemical milling
- Recording holograms using argon lasers
- Microelectronics applications

EMULSION THICKNESS

Unprocessed—6 micrometres (0.24 mil)
Processed—4 micrometres (0.16 mil)

SAFELIGHT RECOMMENDATIONS

Use a KODAK Safelight Filter, No. 1A (light red), or equivalent, in a suitable safelight lamp with a 15-watt bulb, at not less than 1.2 metres (4 feet) from the film.

STORAGE

In its original, unopened package, SO-343 Film should be stored at not more than 24°C (75°F). Refrigeration is desirable, but freezing is unnecessary and may even be harmful. Unopened film which has been refrigerated must be warmed to room temperature before the package is opened (about 3 to 5 hours). This is to avoid condensation of moisture on the film, which may soften the emulsion and allow permanent adhesion of any surface particles.

Once the film package has been opened, store the film at a relative humidity of 30 to 50 percent. After even a few days at higher humidity, the film may no longer be usable. Refrigeration of opened film is not recommended because the relative humidity in a refrigerator is commonly higher than 50 percent, and moisture may condense on the cold film when it is brought into normal room conditions. The film would then be subject to the damage mentioned above.

Film that has been properly processed will retain its value as a photographic record if properly stored. In general, follow the recommendations in ANSI Standard PH1.43-1975, "American National Standard Practice for Storage of Processed Safety Photographic Film." These recommendations deal with the storage conditions, storage facilities, handling, and periodic inspection of films.

Whether for short-term or archival storage of processed film (as defined in PH1.43-1975), environmental conditions somewhat more stringent than those of the Standard are recommended for SO-343 Film. Relative humidity should be 30 to 50 percent without cycling (the lower figure being preferred for archival storage). Temperature should be 15.5 to 21°C (60 to 70°F), without cycling, for either short-term or archival storage (the lower temperature is preferred). The upper temperature limit of 24°C (75°F) is allowed for short-term storage only.

CLEANING

For best quality results, SO-343 Film should be cleaned just prior to exposure to remove any extraneous surface particles which may have adhered to it. A jet of air, nitrogen, or Freon gas is effective for cleaning such particles from the emulsion surface. Be sure that the gas is clean, oil-free, and dry. Use a pressure not greater than 200 psi, with the jet nozzle no closer than 5 cm (2 inches) from the film. An exhaust should be used to carry off any dislodged particles.

SO-343 Film is compatible with the ultrasonic cleaning and ultraclean processing techiques recommended for KODAK High Resolution Plates. However, for applications

requiring the utmost in cleanliness, KODAK High Resolution Plates are recommended where conditions permit the use of rigid substrates.

BASE

SO-343 Film has a strong, dimensionally stable, 7-mil polyester base with a dyed-gel backing for the suppression of halation and curl.

EXPOSURE INFORMATION

Meter Setting:* 0.016 (unfiltered tungsten)

* This meter setting is not an ASA speed. It is based on 8/E, where E is the tungsten exposure (in lux-seconds) required to produce a density of 1.6 above minimum density, using a 30-second exposure, and development in KODAK Developer D-19 for 5 minutes at 20°C (68°F) as recommended.

For exposure meters marked in ASA speeds, use the meter to evaluate reflected light from a white card or from the white side of a KODAK Neutral Test Card. To evaluate incident light or reflected light from the 18-percent gray side of the Neutral Test Card, multiply the meter setting by 5.

In the event that your exposure meter does not have a meter setting this low, multiply both the setting on the meter and the indicated exposure time by the same factor. For instance, you can use a setting of 16 (1,000 times the recommended setting), and if the indicated exposure under your conditions is 1/25 second, use an exposure of 40 seconds (1,000 times 1/25 second).

Contact Exposure: About 10 seconds with a 100-watt lamp at 0.9 meter (3 feet). KODAK High Resolution Film (ESTAR Thick Base) SO-343 has approximately the same working speed as a contact-printing paper.

Camera Exposure: About 15 seconds at *f*/8 with two 45-ampere arc lamps at a 45° angle to, and 2.4 metres (8 feet) from, the copyboard (i.e., with an illumination level of 1,000 footcandles).

To obtain optimum image quality with lenses of extremely high resolving power, SO-343 Film should be exposed with green light. This can be accomplished with green fluorescent lamps or with spectrally broad light sources such as tungsten or arc lamps which have been filtered to absorb blue and ultraviolet radiation. In the latter case, the orthochromatic sensitivity of the film acts to eliminate the effect of red light from the imaging process.

Filters should always be placed over the light source, not over the lens. This avoids the degrading effects of dirt, scratches, fingerprints, or filter wedging in the imaging process. Exposures should be determined by trial under your specific conditions of exposure and processing. (See the section on Latent-Image Fading.)

KODAK WRATTEN Filter No. 12 or No. 15 can be used with this film. The slight ultraviolet transmittance of these filters may be blocked by using a KODAK WRATTEN Filter No. 2A or No. 2C between the light source and the No. 12 or No. 15 Filter. The No. 2A or No. 2C Filter also serves to extend the useful life of the No. 12 or No. 15 Filter; however, these filters should be checked periodically for changes in their spectral transmission characteristics.

Prolonged exposure to intense light sources which are rich in infrared radiation may result in physical damage to the filters. In this case, it may be beneficial to include a heat-absorbing or infrared-rejecting filter in the illumination path.

Sensitometric Effects: During exposure, many sensitometric effects can be caused by such ambient conditions as presence of oxygen, absolute pressure, percent relative humidity, and atmospheric contaminants.* SO-343 Film shows some loss in effective emulsion speed and a reduction in contrast for exposures shorter than 1 millisecond. Increased development will restore speed and contrast, but with a possible increase in minimum density and granularity.

Latent-Image Fading: As with most photographic products having extremely fine-grain silver-halide emulsions, SO-343 Film exhibits a photographic effect called "latent-image fading." When processing is delayed after exposure, this latent-image fading causes the density produced by a given exposure to be lower than it would have been if the film had been processed right away. Contrast is also reduced. The exact rate of fading or decay depends on the conditions under which the film was exposed and kept before processing. A typical example is shown in the latent-image decay curve. Note that the density drops significantly during the first few hours but more slowly thereafter. When constant density (or contrast) is important, a uniform schedule for exposing and processing must be adopted.

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* J. H. Altman and H. C. Schmitt, "Recent Work on Materials for Microphotography," *Proceedings — Kodak Photoresist Seminar, 1969,* Kodak Pamphlet P-209, 1970, pp 5–8; and T. H. James, "Some Effects of Environment on Latent Image Formation by Light," *Photographic Science and Engineering,* 14, 1970, pp 84–96.

The sensitometric curves and data in this publication represent product tested under the conditions of exposure and processing specified. They are representative of production coatings and, therefore, do not apply directly to a particular box or roll of photographic material. They do not represent standards or specifications which must be met by Eastman Kodak Company. The company reserves the right to change and improve product characteristics at any time.

IMAGE STRUCTURE DATA

This information is based on development of the film in KODAK Developer D-19 for 5 minutes at 20°C (68°F) using continuous agitation.

Resolving Power

Test-Object Contrast	Value	Classification
1000:1	Greater than 2,000 lines/mm	Ultrahigh

Diffuse RMS Granularity

Aperture Diameter	Value
48 micrometres	Less than 5*
6 micrometres	12†

* Read at a net diffuse visual density of 1.00. This value represents 1,000 times the standard deviation of density produced by the granular structure of the material when a uniformly exposed and developed sample is scanned with a densitometer calibrated to read American Standard diffuse visual density, and having a circular measuring aperture 48 micrometres in diameter. Granularity is an objective measurement of the spatial variation of sample density that generally correlates with graininess, which is the subjective effect of image nonuniformity upon the observer. Broadly speaking, granularity measurements with the 48-micrometre aperture will indicate the magnitude of the graininess sensation produced by viewing the diffusely illuminated sample with 12X monocular magnification. It should be noted that if the viewing conditions are changed from the specified 12X condition, the published rms values no longer correctly indicate the relative sensations of graininess produced by various samples.

† Same as the above footnote, except that when a 6-micrometre aperture is used it indicates the magnitude of the graininess sensation produced by viewing the diffusely illuminated sample with 96X monocular magnification.

PROCESSING

The use of a stop bath other than water, a hypo clearing agent, wetting agents, Farmer's Reducer, or other processing chemicals which may affect the final image quality is not recommended when processing KODAK High Resolution Film (ESTAR Thick Base) SO-343.

DEVELOP in a tank, using continuous agitation, for the times given below.

Development Times (in minutes)

KODAK Developer	18.5°C (65°F)	20°C (68°F)	21°C (70°F)	24°C (75°F)
D-19	6	5*	4 1/2	3 1/2

* Primary recommendation

Longer development times will give slightly greater speed and contrast but should be avoided, if possible, because of increased granularity and fog. The use of other developers or of longer development times with D-19 Developer may result in dichroic fog (silver stain) and should be avoided.

Note: The following processing steps should be carried out at a temperature within 3°C (5°F) of the developer temperature.

RINSE for at least 30 seconds in running water at 18 to 24°C (65 to 75°F).

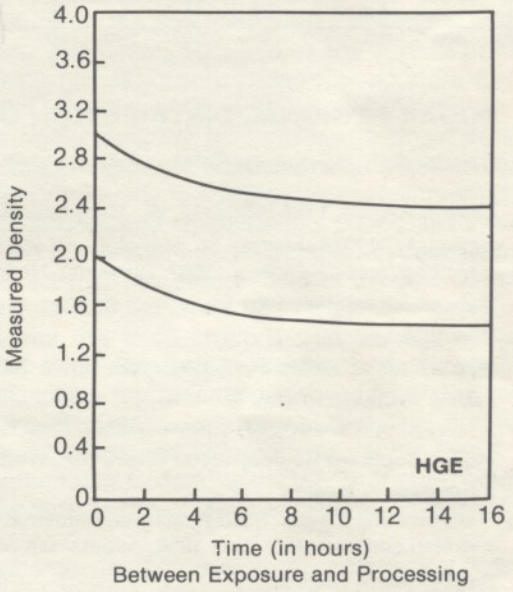
FIX for 1 minute, with frequent agitation, in KODAK Fixing Bath F-5 or in KODAK Rapid Fixer at 18 to 24°C (65 to 75°F).

Caution: Extended fixing times (longer than 2 minutes) may result in some removal of fine images.

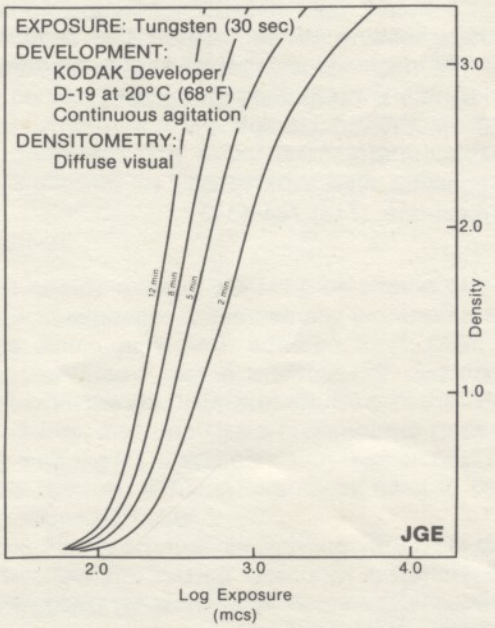
WASH for 5 to 10 minutes in running water at 18 to 24°C (65 to 75°F).

DRY in a dust-free atmosphere.

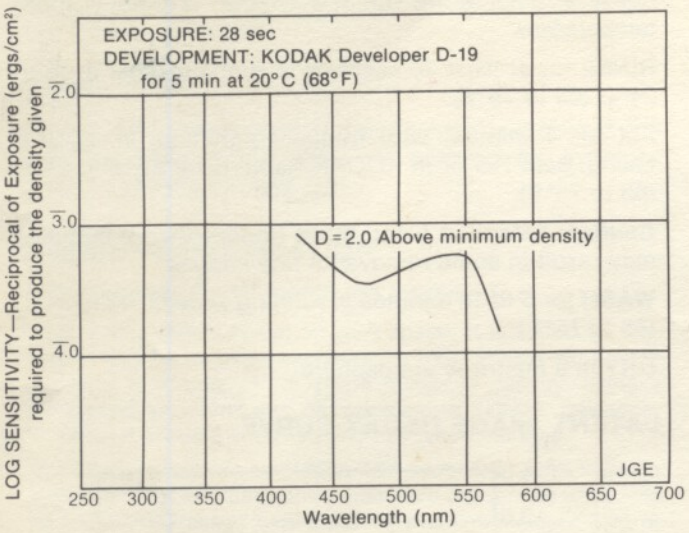
LATENT IMAGE DECAY CURVE



CHARACTERISTIC CURVE



SPECTRAL SENSITIVITY CURVE



SIZE DATA AND ORDERING INFORMATION

KODAK High Resolution Film (ESTAR Thick Base) SO-343 is normally supplied in sheet form with a minimum-order quantity of one package.

Film Size (in inches)	Sheets per Package	CAT No.	Price
4 x 5	25	192 9132	
8 x 10	25	192 9074	

Other sizes are available and are subject to a minimum-order quantity of 750 square feet. Prices will be furnished on request. Orders for all sizes may be placed through any Kodak Regional Distribution Center listed below.

KODAK REGIONAL DISTRIBUTION CENTERS

Distribution Centers open Monday through Friday.

Eastern Region, 1187 Ridge Rd. W., Rochester, NY 14650. Area Code 716: 254-1300. Telex 978429

Hawaii, 1122 Mapunapuna St., Honolulu, HI 96819. Area Code 808: 833-1661. Telex 723354
Mail address—P.O. Box 17007, Honolulu, HI 96817

Midwestern Region, 1901 West 22nd St., Oak Brook, IL 60521. Area Code 312: 654-5300. Telex 255156

New York City Region
Distribution Center, P. O. Box 1334, Route 130, Dayton, NJ 08810. Area Code 201: 329-6600. Area Code 212: 879-1500

Pacific Northern Region
Distribution Center, 9100 Alcosta Blvd., San Ramon, CA 94583. Area Code 415: 828-7000. Telex 336309

Pacific Southern Region, 12100 Rivera Rd., Whittier, CA 90606. Area Code 213: 945-1255. Telex 657434

Southeastern Region
Distribution Center, 5315 Peachtree Industrial Blvd., Chamblee, GA 30341. Area Code 404: 455-0123. Telex 542106
Mail address—P.O. Box 1938, Atlanta, GA 30301

Southwestern Region
Distribution Center, 2800 Forest Lane, Dallas, TX 75234. Area Code 214: 241-1611. Telex 730313

Questions relating to the use of this product or its availability in special-order sizes should be directed to:

Scientific & Technical Photography
Eastman Kodak Company
343 State Street
Rochester, New York 14650
Telephone: (716) 724-4345

Consumer/Professional & Finishing Markets

EASTMAN KODAK COMPANY • ROCHESTER, NEW YORK 14650

KODAK High Resolution Film
(ESTAR Thick Base) SO-343
KODAK Pamphlet No. P-571

087-4-81-D Major Revision
Printed in the United States of America