data release

ATERIALS FOR HOLOGRAPHY

mphlet is to review briefly what holography is, to ents of this relatively new branch of photo- provide some guidance in the selection and handling of Kodak materials that are being used for hologram preparation.

Holography is an exciting, relatively new field that has received wide attention during the past decade. It is probably a safe statement to say that more has been written about holography (and the laser that makes holography practical) — in scientific articles, in the public press, and in popular magazines — than about any other scientific development of modern times. Because most aspects of holography have been ably covered already by many writers, the reader is encouraged to seek a complete discussion of this fascinating science in the published literature. A selected bibliography appears in this pamphlet.

HAT IS HOLOGRAPHY?

Professor Denis Gabor invented holography nearly 30 years ago, during his investigation of ways to reduce spherical aberration in high-magnification electron microscopes. The word *hologram* stems from the Greek root *holos* which means *whole, complete,* or *entire,* and the word *gram* which means *message.* Thus, a hologram is a complete record of a scene or object.

In conventional photography, light from an object or scene is focused by the camera lens onto the photographic emulsion. The resulting exposed and developed plate or film is readily identified as a negative picture of the original subject. Variations in the amount of light reaching the photographic emulsion appear on the negative as varying shades of silver density.

A hologram, on the other hand, may be produced without a lens between the subject and the recording medium, and its appearance usually gives no indication of the scene that it represents. The photographic emulsion is used to record phase and amplitude information from superimposed light waves arriving simultaneously from the subject and from a reference beam. Such information is recorded as a pattern of lines (fringes) which usually are visible only with the aid of a microscope. The photographic emulsions commonly used in holography t have special characteristics in order to yield high- ity holograms.

The image from a hologram is observed by reconstruction; that is, by illuminating the hologram in much the same manner as it was exposed. The observer looks through the hologram, as if looking through a window, and sees an image. Under the right viewing conditions, he can observe an image suspended in space in front of the hologram plane. If a three-dimensional object has been photographed, the image is three-dimensional and exhibits parallax proportional to the size of the window.

Holography, therefore, is distinctly a two-step imaging process, while conventional photography is a one-step imaging process. It is sometimes convenient to think of the hologram not only as a record but as the "lens" in an otherwise lensless system, which is subject to the same types of aberration as a conventional photographic lens.

THE ROLE OF THE LASER

It was the advent of the laser in 1960 that renewed interest in the work performed by Dr. Gabor and by a handful of others during the intervening years. The laser is a light source having very special qualities. Characteristically, lasers emit very intense radiation with a very high degree of temporal and spatial coherence — features which make holography possible. These terms describe radiation, of one or a few discrete wavelengths, which is extremely well organized in space. This organization usually takes the form of a highly collimated beam

or, alternately, one which emanates from a point rather than from an extended source.

Types of Lasers

Lasers are classified by their lasing material (argon, helium-neon, ruby, etc), the principal wavelength(s) they emit, and the duration of radiation emission. Continuous-wave lasers emit constantly during operation; pulsed lasers, on the other hand, emit extremely short flashes of radiation, although sometimes at high repetition rates. Listed below are the lasers that are of most interest from a photographic standpoint.

Helium-neon — Continuous-wave emission at 633 nm.

Ruby — Pulsed emission at 694 nm, though continuous-wave operation is possible.

Argon (or argon-ion) — Continuous or pulsed emission at two principal wavelengths: 488 nm and 515 nm.

Neodymium doped glass — Pulsed emission at 1060 nm. (While radiation at 1060 nm is of marginal usefulness in holographic applications involving conventional photographic materials, it can be converted to 530 nm on passage through frequency-doubling crystals.)

Nd-YAG (for Neodymium doped, Yttrium, Aluminum, Garnet) — Continuous or pulsed emission at 1060 nm.

Krypton — Continuous or pulsed emission at 476 nm, 521 nm, 568 nm, 647 nm.

Helium-Cadmium — Continuous or pulsed emission at 442 nm.

APPLICATIONS OF HOLOGRAPHY

Today, well over 100 scientific laboratories are engaged in holography research and development. Following is a partial list of uses to which holography is being applied.

Dramatic advertising displays
Data storage and retrieval systems
Vibration and stress analysis
Interferometry
Character recognition
Biological research
Particle size and distribution studies
As optical elements

SELECTING A PHOTOGRAPHIC MATERIAL

Holograms have been recorded in a wide range of unusual materials, including dichromated gelatin, photosensitive resists, thermoplastic materials, photochromic films and glass, diazo films, and several crystalline materials. The sensitivity of these materials is typically much lower than that of silver halide emulsions, and some are not responsive at all to red-emitting lasers. The following discussion is limited to silver halide products.

Holographic plates or films must be selected on the basis of several factors: wavelength of the exposing radiation, sensitivity of the recording material, type of hologram desired, processing method, and application or reconstruction mode. Because of these variables, no single product has optimum characteristics or is even usable in all holographic procedures. However, for initial studies in making front- or side-referenced holograms using a helium-neon or ruby laser, we recommend KODAK Holographic Plates, Type 120-02, or KODAK Holographic Film (ESTAR Base) SO-173. The product used in many of the original investigations of laser holography, KODAK Spectroscopic Plates, Type 649-F, continues to be useful for recording reflection (Lippmann-type) holograms or for applications requiring relatively flat spectral response over the range 400 to 680 nanometers. For applications involving exposures with blue or green radiation, KODAK High Resolution Plates and KODAK High Resolution Film (ESTAR Thick Base) SO-343 can be advantageous in several ways.

KODAK Holographic Plate, Type 120-02, and KODAK Holographic Film (ESTAR Base) SO-173

These holographic recording materials share a microfine-grain emulsion with excellent dimensional stability, improved speed-grain ratio, and high sensitivity in the 600- to 750-nanometer region. These products are described in Kodak Pamphlet No. P-311, (see Kodak Publications, page 9).

Safelight. *Total darkness required.* While these materials are very slow by conventional photographic standards, it is recommended that they be handled in total darkness. The practicality of using a KODAK Safelight Filter No. 3 (dark green) or a No. 7 (green) after development is half completed has not been evaluated by Kodak.

KODAK Spectroscopic Plate and Film, Type 649-F

These materials have an extremely high contrast, panchromatic emulsion with spectral sensitivity extending almost to 700 nm. Their useful sensitivity (speed) is characteristic of an emulsion with microfine granularity and ultra-high resolution (2,000 lines/mm). The emulsion thickness on glass plates is 15 to 17 μm before processing, while on flexible supports the emulsion thickness is 6 μm. More information about these products is given in Kodak Publication No. P-315.

Safelight. It is recommended that these materials be handled in total darkness. A KODAK Safelight Filter No. 3 (dark green) may be used for a few seconds after development is one-half completed.

KODAK Spectroscopic Plate and Film, Type I-Z

These materials are included because they are the only available Kodak products with useful sensitivity for wavelengths of 1060 nm (neodymium doped glass laser) and 1150 nm (helium-neon laser). In fact, the Type I-Z emulsion has its peak sensitivity at about 1060 nm. However, they lack the high resolving power of the materials described above. Publication reference: P-315.

Safelight. Handle and develop in total darkness. A KODAK Safelight Filter No. 7 (green) may be used for a few seconds after development is one-half completed.

KODAK High Resolution Plate, Type 1A, KODAK High Resolution Film (ESTAR Thick Base) SO-343, and KODAK High Resolution Plate, Type 2A

KODAK High Resolution Plate, Type 1A, and Type SO-343 Film, have an orthochromatic-sensitive emulsion suitable for recording laser lines out to 560 nm. KODAK High Resolution Plate, Type 2A, has useful sensitivity over the same spectral range as High Resolution Plate, Type 1A, but it provides improved microimage quality for exposure with blue or ultraviolet radiation at the expense of a modest reduction in absolute sensitivity. For holographic applications, these high-resolution materials are comparable in performance characteristics with the Type 649-F products described previously. Both the film and plate have an emulsion thickness (unprocessed) of 6 μm. High Resolution Plates are sold on a direct basis, but only in case quantities. Single packages of certain common sizes are sometimes available through dealers in Kodak microelectronic products. SO-343 Film is factory-stocked in two commonly used sheet sizes and sold on a direct basis from Kodak. See Kodak Publications No. P-47 and P-183 for additional information.

Safelight. Use a KODAK Safelight Filter No. 1A, or equivalent, in a suitable safelight lamp with a 15-watt bulb at no less than 1.2 meters (4 feet) from the plate or film.

RESOLVING POWER

The resolving power values quoted for Kodak products are obtained by classical optical techniques. These methods do not permit reliable determinations beyond 2,000 lines/mm. There is no accepted standard for determining resolving power by holographic means, but practical experience indicates that resolving powers, expressed in *fringes/mm*, are roughly double the published values. In fact, the ability of Type 649-F plates to record reflection holograms with green light establishes that the information is exposed within the emulsion at a spatial frequency of 6,000 fringes/mm although the published resolving power is given simply as "2,000 lines/mm."

EXPOSURE CONDITIONS

In holographic recording, it is important to control the intensity ratio of the two intersecting beams as well as the total exposure representing their sum. In specialized situations, the beams are adjusted to nearly equal intensity. Normally, however, the reference-beam intensity is much stronger, and beam intensity ratios 5:1 to 10:1 are suggested for initial experiments in side-referenced holography. (Ratios in the range 50:1 to 100:1 are used in some cases.)

The total exposure should be adjusted to yield maximum reconstruction brightness. For conventional, side-referenced, "amplitude" holograms, this exposure usually corresponds to an average hologram diffuse density of 0.8. Spectral sensitivity curves can be interpreted to obtain an approximate exposure (in ergs/cm^2) for the midpoint of a trial exposure series. With most processes which generate phase holograms by bleaching the silver image, a somewhat higher exposure level is required; i.e., the material is effectively lower in sensitivity.

SENSITOMETRIC EFFECTS DUE TO EXPOSURE DURATION AND ENVIRONMENT

Sensitometric properties are affected by ambient conditions during exposure such as the presence of oxygen, absolute pressure, percent relative humidity, and atmospheric contaminants.* In addition, the materials described in this pamphlet may show some change in effective emulsion speed and contrast for exposures shorter than 1 millisecond. An increase in development time may help to overcome loss of density.

Latent-Image Decay

A consideration in development is the photographic effect called "latent-image fading." This occurs after exposure and is especially noticeable with microfine-grain emulsions. When processing is delayed after exposure, this effect causes the density produced by a given exposure to be lower than it would have been if processing had not been delayed. The rate of fading or decay depends on the conditions under which the plate is kept before processing. Most density loss occurs during the first few hours after exposure and then continues at a somewhat lower rate thereafter. When constant density (or contrast) is important, a uniform schedule for exposing and processing must be adopted.

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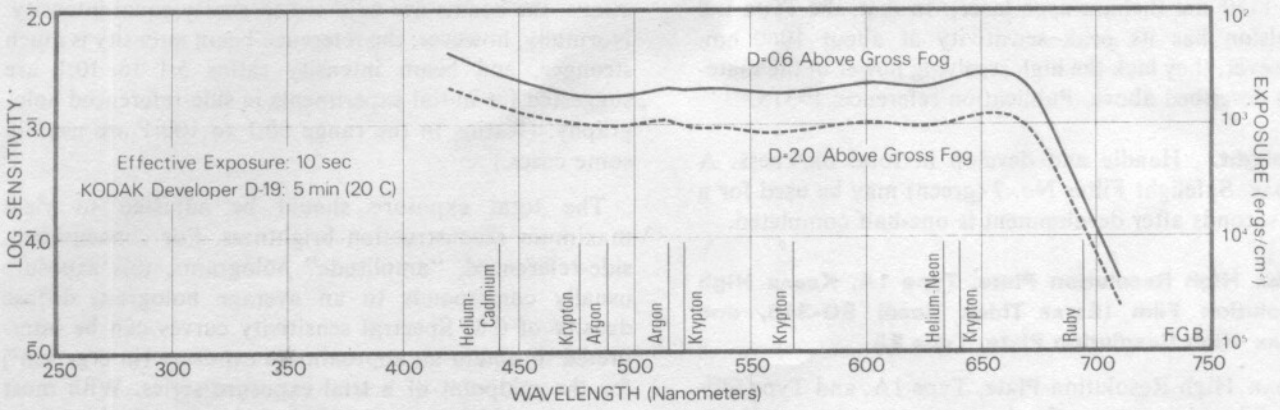
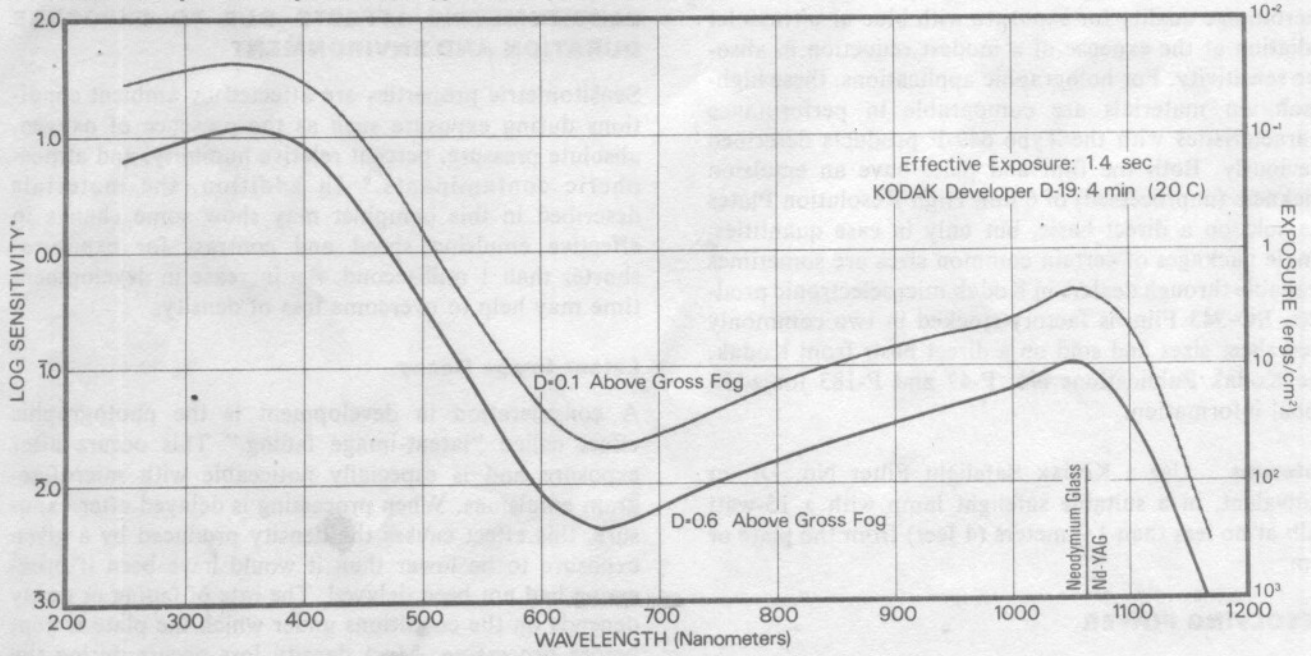
*J. H. Altman and H. C. Schmitt, "Recent Work on Materials for Micro-Photography," *Proceedings — Kodak Photoresist Seminar* — May 19 and 20, 1969, p 209, and 1970, pp 5-8; also T.H. James, "Some Effects of Environment on Latent Image Formation by Light," *Photographic Science and Engineering*, **14**, 1970, pp 84-96.

SPECTRAL SENSITIVITY CURVES

KODAK Spectroscopic Plate, Type 649-F



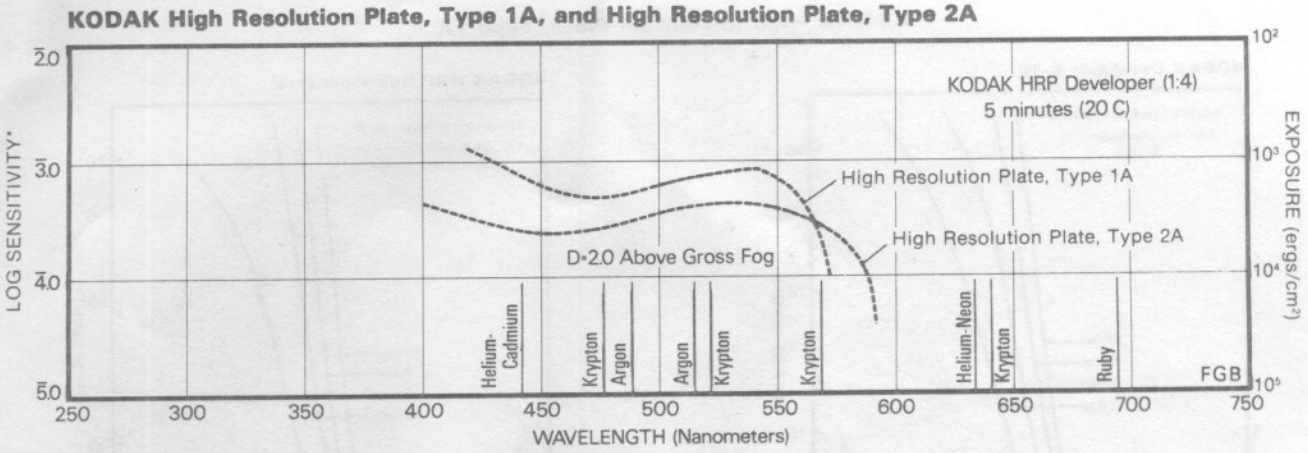
KODAK Spectroscopic Plate, Type I-Z (hypersensitized)



*Sensitivity is defined as the reciprocal of exposure, expressed in ergs/cm², required to produce the indicated density (D) above gross fog when the material is processed as recommended. Exposure in ergs/cm² is shown at the right of the chart.

NOTICE: The sensitometric curves and data in this publication represent products 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.

KODAK High Resolution Plate, Type 1A, and High Resolution Plate, Type 2A

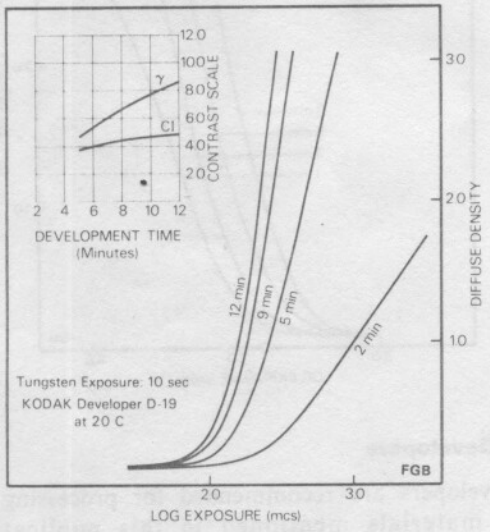


*Sensitivity is defined as the reciprocal of exposure, expressed in ergs/cm², required to produce the indicated density (D) above gross fog when the material is processed as recommended. Exposure in ergs/cm² is shown at the right of the chart.

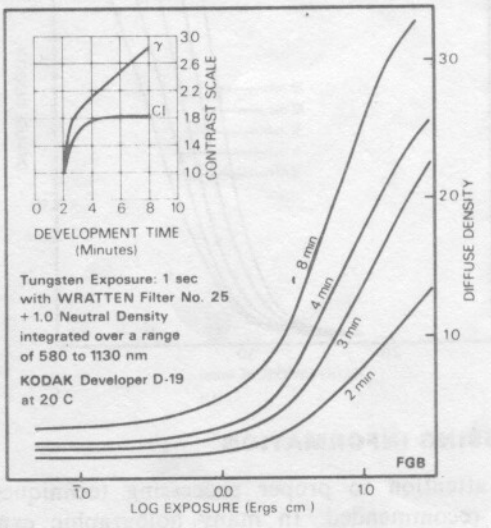
CHARACTERISTIC CURVES

The curves shown here represent average product exposed to radiation (as noted) with an intensity scale sensitometer. Test samples were developed in the recommended Kodak developer at 20 C (68 F) under average processing conditions, with continuous agitation and read by diffuse visual densitometry.

KODAK Spectroscopic Plate, Type 649-F



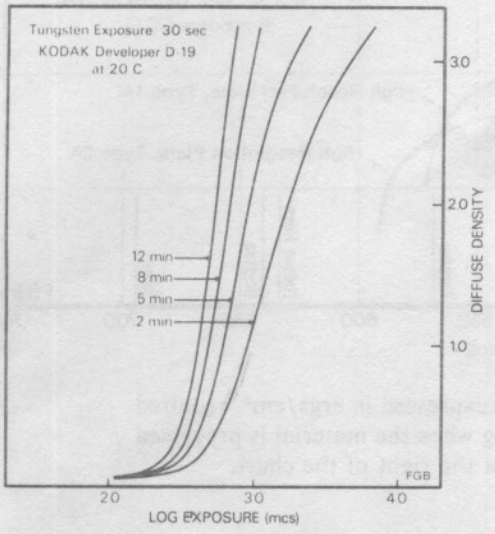
KODAK Spectroscopic Plate, Type I-Z (hypersensitized)



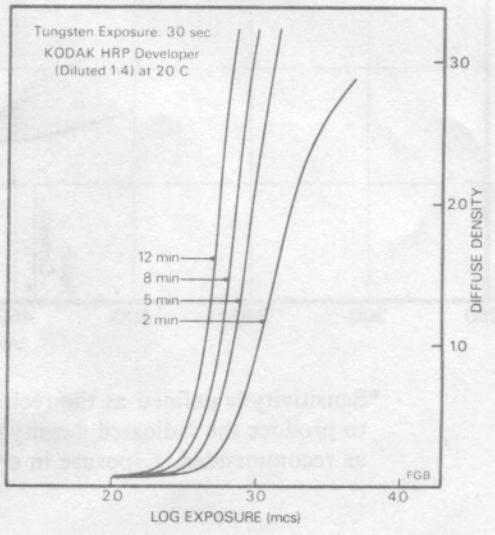
NOTE: Although the curves shown here were generated from tests run on plate samples, curve shapes for films of the same type, if exposed and processed in the same manner, will be comparable, but some slight displacement along the log-sensitivity or log-exposure axis might be expected due to speed differences between plates and films.

KODAK High Resolution Plate, Type 1A

KODAK Developer D-19

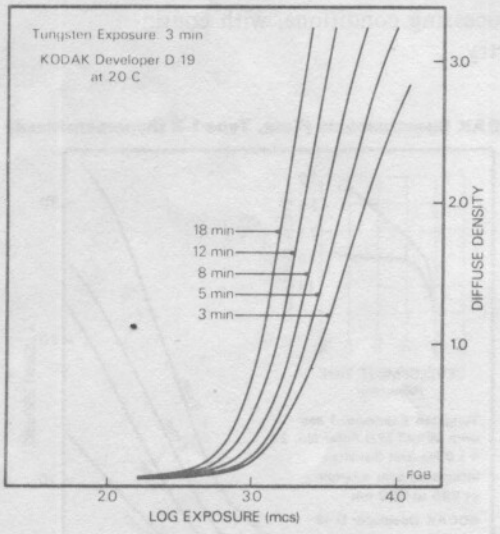


KODAK HRP Developer (1:4)

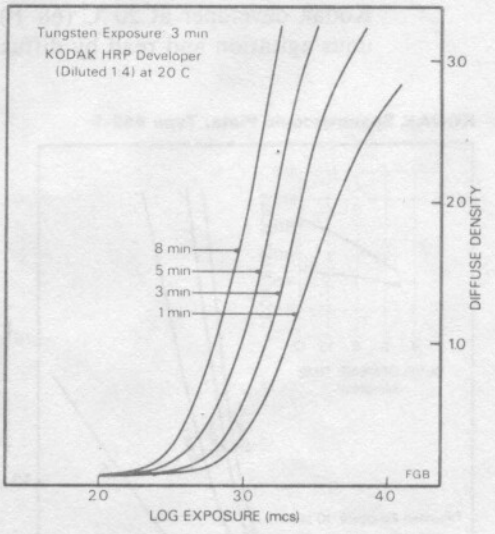


KODAK High Resolution Plate, Type 2A

KODAK Developer D-19



KODAK HRP Developer (1:4)



PROCESSING INFORMATION

Careful attention to proper processing techniques is strongly recommended. In many holographic experiments, results are observed or measured on plates or films that have been exposed singly and processed at different times. In such cases, it is especially important that processing conditions — developer condition, time, temperature, and agitation — be standardized in order to minimize the effect of processing variability.

Proper agitation is especially important. For a complete description of agitation techniques for processing plates and films, see *Processing Chemicals and Formulas*, Kodak Publication No. J-1. We also recommend *Practical Processing in Black-and-White Photography*, Kodak Publication No. P-229.

KODAK Developers

Two developers are recommended for processing the Kodak materials mentioned in this publication. KODAK Developer D-19 is a high-contrast, clean-working developer that produces high-quality holograms with short development times; it is our primary recommendation as a developer for Kodak holographic materials. Developer D-19 is available in prepared powder to make one gallon and 5 gallons of working solution. KODAK HRP Developer, a liquid concentrate available in sizes to make 1 and 5 gallons at a 1:4 dilution, yields high-quality microimages on KODAK High Resolution Plates, Types 1A and 2A. It is not recommended for processing Type 649-F or Type I-Z materials, Type 120-02 plates, or SO-173 film.

Processing Procedure

The processing procedure for the products covered in this pamphlet is summarized in the table below.

Drying

Dry in a dust-free atmosphere. Drying marks can be minimized by treating the plates or films in diluted KODAK PHOTO-FLO Solution after washing, or by wiping the surfaces carefully with a damp KODAK Photo Chamois or a soft viscose sponge. The use of PHOTO-FLO Solution will also aid in drying plate and film surfaces uniformly. For best results, dry plates and films slowly at room temperature.

NOTE: *For highest quality holograms, keep the temperature of all processing solutions, including the wash water, the same. In this way, image movement due to random shifts in the emulsion layer — as the gelatin alternately swells and shrinks during processing — will be minimized.*

PROCESSING SUMMARY

PROCESSING STEPS ➧	DEVELOP with *continuous* agitation at 20°C (68°F) as indicated		RINSE with agitation at 18 to 21°C (65 to 70°F) for the indicated rinsing times (in seconds)	FIX* with frequent agitation at 18 to 21°C (65 to 70°F) for the indicated fixing times (in minutes)		WASH in running water at 18 to 21°C (65 to 70°F) for the indicated washing times (in minutes)
KODAK Plates and Films	KODAK Developer	Development Time (in minutes)	KODAK Indicator Stop Bath or KODAK Stop Bath SB-5	KODAK Fixer or KODAK Fixing Bath F-5	KODAK Rapid Fixer	
Spectroscopic Plates and Films						
Type 649-F Plate	D-19	6 to 8†	30‡	5 to 10	2 to 4	20 to 30
Type 649-F Film	D-19	6 to 8†	Water Rinse Only for 30 Seconds	½ to 1	½ to 1	5 to 10
Type I-Z Plate and Film (Hypersensitized)	D-19	6 to 8†	30‡	10 to 15	3 to 5	20 to 30
High Resolution Plate, Type 1A	D-19 HRP (1:4)	6 to 8† 6 to 8†	Water Rinse Only for 30 Seconds	1	1	5 to 10
High Resolution Plate, Type 2A	D-19 HRP (1:4)	6 to 8† 6 to 8†	Water Rinse Only for 30 Seconds	1	1	5 to 10

*Fixing times are based on 2 to 3 times the time required for the plate or film to clear.

†The *suggested* 6 to 8 minutes development time for all of the product/developer combinations shown above is somewhat longer than Kodak's *recommended* development times for these same combinations, which have been found to produce optimum contrast, fog, and image-structure properties when these materials are used for conventional (broad-band) light-recording applications. While these longer development times reflect the experience of many holographers, shorter or even longer times may produce more desirable results in some situations. Accordingly, we suggest that 6 to 8 minutes *be considered a starting point only.*

‡The use of either of the recommended stop baths with these products may cause small bubbles, or blisters, to form in the emulsion. The net effect may be objectionable "pinholes" in the emulsion. To avoid this condition, use a 30-second water rinse with moderate agitation. To minimize, or possibly eliminate, this problem, reduce the acetic acid concentration of the stop bath.

ORDERING INFORMATION

The products listed in this pamphlet are sold through several channels. Those with red or infrared sensitivity may be ordered through local photo dealers who primarily serve the professional photographer or, alternatively, through selected firms which serve the holographic market by carrying commonly specified sizes of Kodak holographic materials in stock for prompt delivery. Basic marketing channels for the High Resolution Plates and Film are mentioned on page 3. To obtain up-to-date information about product availability, specifications, prices, and where to place orders, write or call the address shown on page 10.

FOR ADDITIONAL INFORMATION

A great deal of information about holography — theory, applications, holographic arrangements and systems —is reported in the literature. Several bibliographies have been compiled, review articles have been written, and a number of texts on holography are now available. Some of these publications are listed here; we suggest that you seek assistance from your local public, college, or university library in locating these sources of information.

In addition, equipment manufacturers, their representatives in the field, and service houses for custom holographic work and supplies are also excellent sources of current information. A partial listing of such manufacturers and suppliers is also included.

Bibliographies

The following bibliographies are especially useful in locating early published articles on holography and related fields, including the classic papers by Gabor, Leith, and Upatnieks.

Chambers, R. P., and Courtney-Pratt, J. S., "Bibliography on Holograms." *Journal of the SMPTE*, **75**: 343-435 (1966).

_____"Bibliography on Holograms—II." *Journal of the SMPTE*, **75**: 759-809 (1966).

Chambers, R. P., and Stevens, B. A., "Bibliography on Holograms—III." *Journal of the SMPTE*, **76**: 392-5 (1967).

Latta, J. N., "A Classified Bibliography on Holography and Related Fields." *Journal of the SMPTE*, **77**: 422-58 (1968).

_____"A classified Bibliography on Holography and Related Fields." *Journal of the SMPTE*, **77**: 540-80 (1968).

Reviews and Collections of Papers on Holography

Close, D. H., "Holographic Imagery." *Industrial Research*, **14**: No. 8, 34 (1972).

Gabor, D., Kock, W. E., and Stroke, G. W., "Holography." *Science*, **173**: No. 3991, 11 (1971).

Materials Research and Standards, **11**: No. 9 (September 1971). Contains 7 articles.

Physics Today, **25**: No. 3 (March 1972). Contains 4 papers including a state-of-the-art review by Leith and Upatnieks.

Proceedings of the IEEE, **59**: No. 9 (September 1971). Contains 4 papers.

Selected Texts on Optical Holography

Barrekette, E. S., *et al*, eds., *Proceedings of the United States-Japan Seminar on Information Processing by Holography, Washington, D.C., October 13-18, 1969.* New York, Plenum, 1971.

Cathey, W. T., *Optical Information Processing and Holography*. New York, Wiley-Interscience, 1974.

Caulfield, H. J., and Lu, Sun, *The Application of Holography*. New York, Wiley-Interscience, 1970.

Collier, R. J., Burckhardt, C. B., and Lin, L. H., *Optical Holography*. New York, Academic Press, 1971.

Erf, R. K., ed., *Holographic Nondestructive Testing*. New York and London, Academic Press, 1974.

Francon, M., *Holography*. New York and London, Academic Press, 1974.

Greguss, P., Editor, *Holography in Medicine*. London, IPC Science and Technology Press, Ltd, 1975.

Kock, W. E., *Engineering Applications of Lasers and Holography*. New York, Plenum, 1975.

Kock, W. E., *Lasers and Holography*. New York, Wiley-Interscience, 1969. (Available in both hard-cover and paperback editions.)

Lehmann, M., *Holography - Technique and Practice*. London, Focal Press; and New York, Hastings House, 1970.

Nesterikhin, Y. E., Stroke, G. W., and Kock, W. E., *Optical Information Processing*. New York, Plenum, 1976.

Shulman, A. R., *Optical Data Processing*. New York, Wiley-Interscience, 1970.

Smith, H. M., *Principles of Holography*. Second Edition. New York, Wiley-Interscience, 1975.

Stroke, G. W., *Introduction to Coherent Optics and Holography*, Second Edition. New York, Academic Press, 1969.

Yu, F. T. S., *Introduction to Diffraction, Information Processing and Holography*. Boston, M.I.T. Press, 1973.

Kodak Publications

Eastman Kodak Company publishes more than 750 data books and pamphlets on such topics as scientific photography, darkroom techniques for black-and-white and color photography, applied photography and many other subjects. These publications are listed in the *Index to Kodak Information*, publication No. L-5.

Here are the items in the *Index* that are referenced in this pamphlet:

DATA BOOKS

Processing Chemicals and Formulas (J-1).....$1.50

Practical Processing in Black-and-White Photography (P-229).....$1.25

KODAK Plates and Films for Scientific Photography (P-315).....$2.50

The Data Books listed above are available through your photo dealer. In some instances, however, publications dealing with specialized photography are not stocked by all dealers. They may be ordered directly from:

Department 454
Eastman Kodak Company
343 State Street
Rochester, New York 14650

The order should include the title and code number of the publication and the correct remittance plus any applicable state or local taxes.

List prices shown are suggested prices only and are subject to change without notice. Actual selling prices are determined by the dealer.

Every effort is made to keep publications in stock and available at all times. While we will attempt to ship your order more quickly, if we find we cannot supply the publications to you within 60 days, we will refund your money and try to give you a projected publication date so that you can reorder or make a substitution.

PAMPHLETS

KODAK High Resolution Plates (P-47)

KODAK High Resolution Film (ESTAR Thick Base) Type SO-343 (P-183)

KODAK Holographic Plate, Type 120-02 and *KODAK* Holographic Film (ESTAR Base) SO-173, (P-311)

Index to Kodak Information (L-5)

To obtain a complimentary copy of these pamphlets, write to Department 412-L at the address given above.

IMPORTANT: For prompt shipment of Kodak publications, do not include requests for technical information or other correspondence with your order for publications.

Some Manufacturers or Suppliers of Holographic Apparatus, Holographic Cameras, and Specialized Plate holders

Ardel Kinamatic
125-20 18th Avenue
College Point, New York 11356

Data Optics, Incorporated
115 Holmes Road
Ypsilanti, Michigan 48197

The Ealing Corporation
Optics Division
2225 Massachusetts Avenue
Cambridge, Massachusetts 02140

Gaertner Scientific Company
1201 Wrightwood Avenue
Chicago, Illinois 60614

Hadron/Korad
2520 Colorado Avenue
Santa Monica, California 90406

Jodon Engineering Associates, Inc.
145 Enterprise Drive
Ann Arbor, Michigan 48103

Metrologic Instruments, Incorporated
143 Harding Avenue
Bellmawr, New Jersey 08030

Modern Optics Corporation
2207 Merced Avenue
El Monte, California 91733

Newport Research Corporation
18235 Mt. Baldy Circle
Fountain Valley, California 92708

Optimation
358 Baker Avenue
Concord, Massachusetts 01742

Oriel Corporation of America
1 Market Street
Stamford, Connecticut 06902

Quantrad Corporation
139 Illinois Street
El Segundo, California 90245

For a comprehensive listing of firms which manufacture or distribute lasers and other specialized equipment useful in holography, we suggest you consult *Laser Focus Buyers' Guide*, a copyrighted publication of Advanced Technology Publications, Inc., 385 Elliot Street, Newton, Massachusetts 02164.

Before You Write or Call Kodak

Kodak receives many general requests for information about Kodak materials used in holography, as well as inquiries about new or existing products that may be suitable for holographic recording equipment still in the early stages of development. Such requests are welcome, indeed, and should be directed to the following address:

Scientific and Technical Photography
Department 757
Eastman Kodak Company
Rochester, New York 14650
Telephone: (716) 724-4345

Experience has shown that we can be most helpful, and more prompt, in replying to your requests for technical information, if you can provide us certain basic information about your equipment and the nature of the work you are planning to do. Having such information will enable us to recommend the most effective and economical materials that are currently available. As a guide to assembling this information for your letter (or telephone call, if you wish), it will be most helpful if you can supply us information on the following points:

1. Laser
   a. Type
   b. Wavelength(s)
   c. Power or energy output
2. Type of hologram (reflection, Fresnel, Fraunhofer, etc)
3. Application
4. Maximum spatial frequency to be recorded
5. Recording medium
   a. Plate
   b. Film (roll or sheet)
   c. Size
   d. Winding specification, if a roll film
   e. Estimated consumption
6. Processing
   a. Conventional (amplitude hologram)
   b. Bleaching method (phase hologram)

Scientific and Technical Photography

Professional and Finishing Markets Division

EASTMAN KODAK COMPANY • ROCHESTER, N.Y. 14650

KODAK Materials for Holography

Kodak Pamphlet No. P-110

8/76 Minor Revision

Printed in the United States of America