

PHOTOGRAPHERS' FORMULARY

GP-2 HOLOGRAPHY PROCESSING KIT TO MAKE 1 LITER OF STOCK SOLUTION

The GP-2 developer is the latest formulation by Dr. Tung H. Jeong of Lake Forest College. The GP-2 developing procedure is most suitable for the Russian-produced fine-grain emulsion now known as PFG-03M. Both the developer and the emulsion are discussed in the book "Silver Halide Materials for Holography and Their Processing" by Dr. Hans Bjelkhagen and published by Springer-Verlag. The book and the materials are distributed by INTEGRAF LLC, Holography Supplies Source, 218 Main St #674, Kirkland WA 98033 (Phone: (650) 351-5003, Fax: (650) 351-0013, E-mail: (Info@integraf.com).

FOR YOUR CHEMICAL SAFETY

All chemicals are dangerous and must be treated with respect. Please read all the warning labels on each package.

It is good practice to use eye goggles, dust mask, apron and rubber gloves when mixing chemicals.

HYDROQUINONE is considered by the EPA to be hazardous, and to be a skin sensitizer.

POTASSIUM HYDROXIDE, like sodium hydroxide, is a dangerous chemical, since it is a corrosive and if spilled on the skin will cause a chemical burn. Its action is insidious because the burn occurs without pain. Wash your hands frequently without soap, so that if you detect a soapy feeling while washing potassium hydroxide is present. If so, wash thoroughly with soap and water. Pellets of potassium hydroxide are easily spilled during solution preparation. If spillage occurs outside of a sink, all of the spilled solid must be cleaned up. Use a damp disposable towel. If the solid is not cleaned up it will absorb the moisture from the air and form a puddle of very caustic hydroxide that will not evaporate.

We strongly urge you to wear both safety glasses and rubber gloves when working with solid potassium hydroxide and its solutions.

All other chemicals contained in this kit are considered non-hazardous, but we ask you to still use care by using a dust mask and rubber gloves.

The user assumes all risks upon accepting these chemicals. IF FOR ANY REASON YOU DO NOT WANT TO ASSUME ALL RISKS PLEASE RETURN THE KIT WITHIN THIRTY (30) DAYS FOR A FULL REFUND.

Consult with local sewer and water authorities regarding proper disposal of darkroom chemicals in your area.

MIXING THE STOCK SOLUTION

The chemicals in this kit are used to prepare one concentrated stock solution, which is diluted to working solution as needed.

TO MAKE THE STOCK SOLUTION

CHEMICAL	AMOUNT
Distilled water (50-60C/125-145 F)	1000 ml
Phenidone	0.2 grams
Hydroquinone	5.0 grams
Sodium Sulfite (Anhydrous)	100 grams
Potassium Hydroxide	5.0 grams
Ammonium Thiocyanate	12.0 grams

Consult a professional chemist or a certified chemistry teacher concerning safety procedures for mixing and using chemicals. Observe all safety rules at all times.

The content of each of the five chemicals is dissolved in one liter of distilled or de-ionized water warmed to 50 - 60 C (125 - 145 F). To open each pouch, tap the chemical to the bottom and then cut open the top with a pair of scissors. Invert the open pouch very close to the top of the water and empty the contents into it. Avoid letting the contents escape into the air.

Keep the stock solution in a tightly capped bottle and label it as "GP-2 Developer, Stock". When refrigerated (not frozen), this solution should be good for one year. If it becomes yellow, dispose of it.

MIXING THE WORKING SOLUTION

To make a "working solution", mix 15 ml of the stock solution with 400 ml of distilled or de-ionized water. Label this as "GP-2 Developer, Working Solution". Keep this at room temperature, and use the same day.

Both the stock and working solutions should be as clear as water. If the solution turns yellow it must be discarded. Each liter of working solution should be enough to develop 10 2.5x2.5 inch holograms.

HOLOGRAM EXPOSURE

The sensitivity of the PFG-03M emulsion is about 1.5 milli-Joule/cm², which is a factor of 15 lower than Agfa's 8E75 emulsion. But the PFG-03M has a resolution of 10,000 lines/mm, twice that of the Agfa material, resulting in brighter and clearer holograms. Since the sensitivity changes based on the history of the emulsion (age, storage conditions, etc.), each batch should be tested for optimum exposure. **In general, the exposure time for PFG-03M plates should be 15 times longer than for Agfa 8E75 plates.** The superior hologram you get is well worth it!

Because of the longer exposure, vibration becomes a more severe problem. Furthermore, air movement between the hologram being exposed and the object affects the quality of the hologram. Cover the system with a large cardboard box (painted black inside) and let the air settle for one minute before each exposure. One of the best ways of making a reflection hologram is to use a solid object (metal or porcelain, not cloth or rubber) and lean the plate against it (emulsion side facing the object).

A 5-milliwatt HeNe laser with its beam expanded by a lens or concave mirror to a diameter of just greater than 2.5 inches, produces an exposure time of about 5 seconds. Vibration isolation is absolutely required.

Handle the plates by the edges only! Never touch the emulsion (sticky) side. The emulsion is very soft and has the consistency of gelatin.

DEVELOPING PROCEDURES (at room temperature)

Make and develop holograms in a darkened room illuminated by a minimum of green light. A green bulb such as those from a Christmas tree decoration can be used underneath the counter or table. Place obstructions around the light so that after dark adaptation, enough light remains so that the holographer can safely move around. Make certain that there is no direct light on the holographic plate.

In a tray slightly larger than the hologram, fill with enough working solution of GP-2 so that the hologram will be fully submerged and have at least 1 cm of solution above it. Remember, one liter of stock yields 27 liters of working solution, so don't be stingy. Develop each hologram with a tray of fresh solution.

1. Developing: place the exposed hologram into the solution with the emulsion side up. **Do not agitate**. Cover the tray with something opaque and let develop for 12-15 minutes. The finished hologram should appear brownish but clear. If the plate appears colorless, it is under-exposed.
2. Wash the developed hologram in slowly running water for 2 minutes (or agitate slowly in a tray of clean water).
3. (Optional) Soak hologram in dilute photoflo-type solution for 30 seconds.
4. Stand the hologram vertically against a wall or surface, with some paper towels or tissue paper underneath. The emulsion side should face open air. Let the hologram dry naturally, the slower the better. This can take from 20 to 40 minutes.

For transmission holograms, an image can be viewed (with laser light) while the hologram is still wet. For reflection holograms, a transmission image can be seen while wet, but the sharp image to be viewed with an incandescent point source can be seen only when the hologram is thoroughly dried.

For reflection holograms, the emulsion which faced the object during exposure should be spray painted (not brushed) with a diffused black paint (sometimes called charcoal-black or antique-black) Common brands that work well are Krylon® and Rust-o-leum®.

STORING PLATES AND DEVELOPER

To extend their shelf life, both holographic plates and developer should be stored in a refrigerator when not in use. The plate box should be sealed with duct or electrical tape that does not allow moisture to enter the box. Plates should be allowed to reach room temperature before opening in order to prevent condensation.

Keep from children. Label the packages clearly as poisonous materials not to be consumed.

When mixing the working solution, shake the bottle until all the precipitate is dissolved. Use a generous amount of developer and discard when it turns yellow. GP-2 Hologram Developer



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PHOTOGRAPHERS' FORMULARY SAFETY BULLETIN: HYDROXIDES

Hydroxides that are commonly used in photographic practice include Ammonium Hydroxide solution ($\text{NH}_4\text{OH}_2\text{O}$), Lithium hydroxide (LiOH), Potassium Hydroxide (KOH), and Sodium Hydroxide (NaOH)

Each of these chemicals, in solid or liquid form, is extremely caustic. Since caustic materials by definition are capable of dissolving protein, including animal tissue, one should understand the behavior of these materials and the proper techniques for handling them.

Solutions of the hydroxides, if spilled on the skin, will slowly dissolve it, and if splashed in the eye, can cause blindness in a short time. The dry material is hygroscopic, and will absorb water from the air or body to form a caustic liquid very readily.

IF HYDROXIDES CONTACT THE SKIN: Wash the area thoroughly with running water until the slipperiness is no longer present. Slipperiness is due to the hydroxide dissolving the skin. If desired, rinse with vinegar or working strength acid stop bath. Wash thoroughly. Treat damaged tissue as a burn.

IF HYDROXIDES CONTACT THE EYE (dry or wet): Place your head at once under running water (the sink is fine) and wash the eye for 5 to 10 min. Don't bother with eyewashes, etc. Time is all-important. **WASH THE EYE FIRST**, and then call a doctor at once.

To dissolve the hydroxide, simply stir the pellets into the solvent. It will dissolve very readily. It will not be necessary to pulverize the pellets or flakes. Large amounts of heat are liberated when hydroxides are dissolved, and if care is not taken, glassware may be broken or spattering may occur. It is prudent to dissolve a portion of the hydroxide, allowing the solution to cool before proceeding. Use cold or ice water when dissolving hydroxides.

Be sure to pick up all the pellets that accidentally spill. The solid material will pick up moisture from the air and in time, a very concentrated, and very caustic solution forms. Dispose of hydroxide solutions by flushing down the sink or toilet with large amounts of water.

Since damage to flesh or eye can be serious, we strongly suggest the use of safety glasses and gloves when handling caustics. The use of beakers with handles is advantageous, as they are less likely to be dropped. The most important safety precaution is to take the time to move deliberately and carefully. Caustics should not be handled in the presence of children or pets.

All substances can be dangerous. Any material can be handled with safety if the correct precautions are followed. In many years of handling caustic solutions and other potentially hazardous chemicals, we have had no serious difficulty, and with a reasonable amount of care, you need have no problems. We counsel respect, but not fear.