

DEVELOPMENT PROCEDURE FOR ULTIMATE U25 PLATES exposed with continuous or pulsed laser

Version of 07 September 2017, by Yves GENTET

The proposed development method is easy to implement and uses development products optimized by the manufacturer.

PROCESSING

Materials required:

- One light tight box to hold the plate to be exposed
- 3 cans of products: developer (ready to be used), bleach (ready to be used) and drying water (distilled or de-mineralized water with a few drops of Photoflo added)
- a fourth can is needed in case of use of pulsed laser (a 6% weight triethanolamine TEA solution)
- a processing tray: 8x8cm for 6.1x6.1cm plates; 12x15cm for 10.2x12.7cm plates and 32x42cm for 30x40cm plates. A white or better transparent color is recommended to visualize the process (see the density of the plate).
- clean running water
- A LED allowing you to work in safelight
 - Green LED for red sensitive plates
 - Red LED for blue and green sensitive plates

Your plate should only be taken out under safelight until the end of the revelation.

Optional: lint-free paper towels + electric hair dryer for those who cannot wait for natural drying.

After removing the holographic plate from the refrigerator and its protective packaging (in a dark room) and let it adjust to room temperature (at least 30 minutes prior to exposure). This waiting time is not needed if you do the step 0.

0 Pre-sensitization: for pulsed laser exposure only: soak the plate in the 6% weight solution of TEA (with some drops of photoflo) during 2 minutes. Remove the plate, keep it vertical for 30 seconds and then dry it softly with the lint-free paper towels. (3 times in cross directions). Dry it totally with the electric hair dryer. This technique is necessary to avoid the non-reciprocity of the material at short exposure (ns).

BEWARE: the TEA solution should be made fresh. After 1 or 2 weeks the solution doesn't work so well. After one month it is clearly not working anymore.

① Exposure:

Transfer the plate into a light tight box for transport. The plate is then ready for exposure.

For the power/energy output of your laser, you must adjust for an exposure of about $30\mu\text{J}/\text{cm}^2$. (High ratio ref/object 10/1 or 20/1 are possible, as the material has a very high contrast). If you do not have a power meter/ or joule meter, depending the laser used, estimate or call our technical support for help. Please be ready with the laser characteristics and description of your bench when calling.

② Development:

The developer provided in the kit is optimized for Ultimate plates. Gloved should be used to manipulate it.

If the developer comes in a can of 550ml concentrated – you will need to dilute with water, in one time and store it in accordion bottle to remove the air.

If the developer comes in two bags of powder, prepare it according instructions bellow:

Preparation of the developer (if it has been received in two bags of powder):

There are two bags: A and B

Gloved and mask should be used during the manipulation.

- 1) Heat 1L of de-mineralized or distilled water at 35°C .
 - 2) Pour the powder from the bag A and mix with a magnetic agitator until dissolution. (A little bit of powder may remain.)
 - 3) Add the powder from the bag B (activator, soda NaOH), it helps ending the dissolution of the developer in few minutes.
 - 4) Once the developer is dissolved, store it in an accordion bottle to remove the air.
- The developer can be kept several months if there is no air in the bottle

Development time: 1 to 8 minutes à $20^\circ\text{-}25^\circ\text{C}$ under safe-light

UNTIL A DENSITY BETWEEN 2.5 AND 3 IS REACHED.

In case of low exposure (less $30\mu\text{J}/\text{cm}^2$), the process can be done in a developer at 50°C (processing time is then typically 1 min).

The developer effect will start to be visible a few seconds after the plate is covered with the developer. Check for the density every 30 second, and stop the development by putting the plate under tape water, for some seconds or better in a water with some drops of acetic acid.

After development, the Ultimate 25nm plates will be black (with a density of 3) where exposed and transparent where not exposed. A good way to control that the plates are still good, is to place a black tape at a corner of the plate, on both side. This corner should appear transparent after processing.

② Rinse / Stop Bath:

Rinse under running water for 30 seconds in the tray, allowing water to overflow into a sink.

③ Bleach:

The bleach comes as a powder, it must be diluted one time in a liter of demineralized or distilled water. It can handle at least two hundred of 10.2x12.7cm or 20 30x40cm holographic plates. It is considered "dead" when it does not bleach a plate in less than 10 minutes. Even weakened, it gives the same quality of holograms. It conserves for years well when stored at room temperature.

Pour the plate into the developing tray containing the bleach and agitate continuously until you get good transparency (1 to 4 minutes).

Wash the plate under running water for 1 minute.

④ Second Rinse: Rinse under running water for 2 minutes

For maximum transparency and long term stability of the transmission hologram, you can use a solution of dichromate (for 1L: **2g** of Sodium dichromate or Potassium dichromate and **1.5mL** of Sulphuric acid) for 30 seconds. Then rinse under running water.

BE CAREFULL DICROMATE IS POISONOUS

A final solution of water with some drops of acetic acid stabilizes quite well too.

Drying: use a demineralized or distilled water solution with some drops of Photoflo added.

Alternative 1 (no contact): vertical natural drying, no contact with the emulsion.

- 1) Soak 1 minute in this solution.
- 2) Remove the plate gently and allow to dry vertically for 15-20 minutes.

Alternative 2 (faster but with a small risk of scratching the plate)

Care is required to avoid scratching the plate.

- 1) Soak 1 minute in this solution.
- 2) Wipe the gelatin side of the plate very gently, with paper towel folded in 4, until the surface is dry. Rotate the plate 90 degrees each time the entire plate is wiped (to eliminate streaking).
- 3) Now finish with a hair dryer (at moderate heat and not too close).