Development Procedure for Ultimate U25 Plates exposed with continuous or pulsed laser

version of 30 August 2010, by Yves GENTET

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

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 forth can is needed in case of use of pulsed laser (4% weight triethanolamine TEA solution)
− a processing tray: 8x8cm for 6.1x6.1cm plates; 12x15cm for 10.2x12.7cm plates and 32x42cm for 30x40cm plates. Flat bottom tray to limit the quantity of developer, and white color to visualize the process are preferred.
- clean running water

• **lint-free paper towels + electric hair dryer.**

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.

❶ **Pre-sensitisation:** for pulsed laser exposure only: soak the plate in the 4% weight solution of TEA during 1 minute. Remove the plate, keep it vertical for 30 seconds and then dry it softly with the lint-free paper towels. (3 times in perpendicular directions). Dry it totally with the electric hair dryer. This technique is necessary to avoid not reciprocity of the material at short exposure (ns). It triple easily the diffraction efficiency of the material, comparing an exposure without TEA. It has no effect on continuous lasers.

BEWARE: the TEA solution should be made fresh. After 1 week the solution works not so good. After one month it is clearly not working anymore.

❶ **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 30µJ/cm². (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.

❷ Development :

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

It comes in cans of 120ml (or 550ml) concentrate – you will need to dilute with water, in one time. Keep the ready for use developer in a black accordion bottle for developer. Like that you can store it, oxygen free, during more than one year.

Development time : 1 to 5 minutes @ 20°-25°C under safe-light (green LED for red sensitive plates, or red LED for blue-green sensitive plates) **UNTIL A DENSITY OF 3 IS REACHED**.

In case of low exposure ($10\mu J/cm2$), the process can be done in a developer at 30°C.

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.

After development, the Ultimate 08nm plates will be back (with a density of 3) where exposed and transparent were not exposed. It is a good way to control that the plates are still good, to plate a black tape at a corner of the plate, on both side. This corner should appear transparent after processing.

(to install photo)
Example of Ultimate 25 plate after development (color is black).
Exposure: 30 µJ/cm² with a Ruby pulsed Laser

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

❸ Bleach:

The bleach in the kit is a Feric EDTA bleach.Gloved should be used to manipulate it. It is delivered without the sulfuric acid, when delivered under powder form (you must add 10ml of it per liter), and ready for use when delivered under liquid form. When it comes as a powder, it must be be diluted one time in a liter of water + add 10ml of sulfuric acid. It can handle at least one hundred 10.2x12.7cm 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 well when stored at room temperature – for up to a year.

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.

(photo to install after bleach)
Transmission hologram illuminated by an halogen lamp after bleach but before drying.

When the hologram is successful, this image will be very strong (extremly bright rainbow image).

❸ Second Rinse: **Rinse under running water for 2 minutes**
For maximum transparency, if you need it, bleach again for 30 seconds more - then rinse again.

❹ 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). The holographic image will quickly appear.

Final result:

(to make photo)

Hologram on Ultimate 25 plate
Exposed with Ruby Laser - Reconstructed in laser light

Criteria for judging the quality of the hologram:
- if the hologram is bright but the plate is milky white / opaque: over-exposed
- if the hologram is dim and the plate is transparent: under-exposed (or movement)
- if the hologram is bright and the plate is transparent: perfect exposure