

How to Develop PFG-03C (Color) Emulsion for Reflection Holograms—An Overview

2006 © Integraf LLC. All rights reserved.

The main concern in developing PFG-03C for reflection holograms is shrinkage of the emulsion. For reflection holograms, minute shrinkage of the emulsion after development can alter the observed colors of the finished hologram. That's because the shrinkage changes the distance between the Bragg planes, and thus the wavelength that influences the color observed. An example of color shifting in our everyday life can be found common soap bubbles, whose colors change as the thickness of the bubbles change. For more detail on Bragg planes, see the pamphlet *HOLOGRAPHY* by Tung H. Jeong.**

Incidentally color transmission holograms are not affected by shrinkage, and thus can be developed using JD-4 or JD-2 alone for the most part. The drawback, or course, is that color transmission holograms require different color lasers to view the hologram in color.

For color reflection holograms, there are two practical ways to deal with shrinkage. The first, and easier way, is to reverse the shrinkage in effort to restore the intended color. The second and more complex, but more effective, way is to prevent the shrinkage in the first place so the intended colors are captured.

METHOD 1 (Reverse Shrinkage)

Easier method but holograms may not turn out as bright, and the colors may slightly shift, e.g. Red could become slightly orange.

1. Process with JD-2 or JD-4 developer kit.
2. Afterwards, soak the emulsion in a weak solution of triethanolamine (commonly called TEA), which discussed in detail in Graham Saxby's book *PRACTICAL HOLOGRAPHY, 3rd edition (2003)*.** This swells the emulsion (thus reversing the original shrinkage). TEA is an oil that mixes with water to keep the emulsion swelled up. TEA can be purchased from Fisher Scientific International.

METHOD 2 (Prevent Shrinkage)

More complex method requiring use toxic formaldehyde and specially prepared bleach. However, holograms will turn out bright with significantly reduced color shifting.

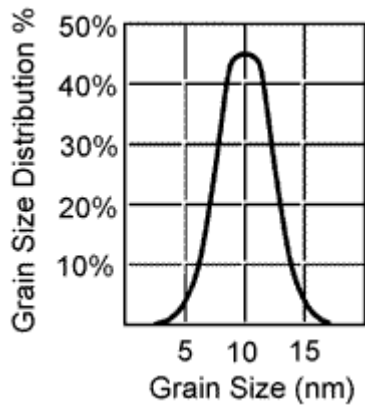
1. After exposure, treat with formaldehyde to harden emulsion before development. Formaldehyde can be purchased from Fisher Scientific International.
2. Develop with JD-2.
3. Prepare a bleach solution that uses Amidol. See article by Hans Bjelkhagen, Tung H. Jeong, and Dalibor Vikicevic, "Color Reflection Holograms Recorded in a Panachromatic Ultra-high Resolution Single Layer Silver Halide Emulsion" (*The Society of Imaging Science and Technology*, 1996, 134-142).**

**All literature cited above can be obtained by contacting at Integraf.

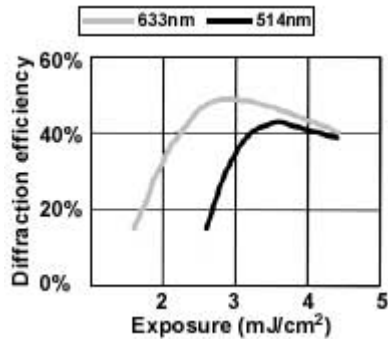
TECHNICAL SPECIFICATIONS

FOR PFG-03C HOLOGRAPHIC PLATES

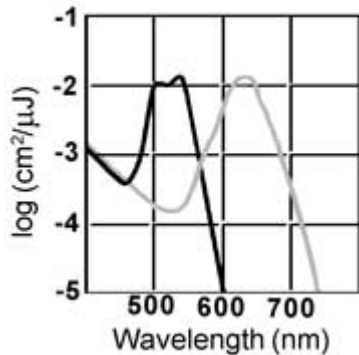
GRAIN SIZE DISTRIBUTION



DIFFRACTION EFFICIENCY



SPECTRAL SENSITIVITY



Ultra Fine-grained panchromatic (full color) holographic plates designed for color reflection hologram recording. Average grain size is 8 nm, resolving power more than 5000 lines/mm, spectral sensitivity range up to 700 nm (457 nm, 514 nm, 633 nm), and emulsion thickness 9-10 μm .

Holographic plates, developer, and other supplies can be purchased from:

INTEGRAF LLC
218 Main Street #674
Kirkland, WA 98033
Phone: (425) 821-0772
Fax: (425) 821-0773
Email: info@integraf.com
Website: <http://www.integraf.com>