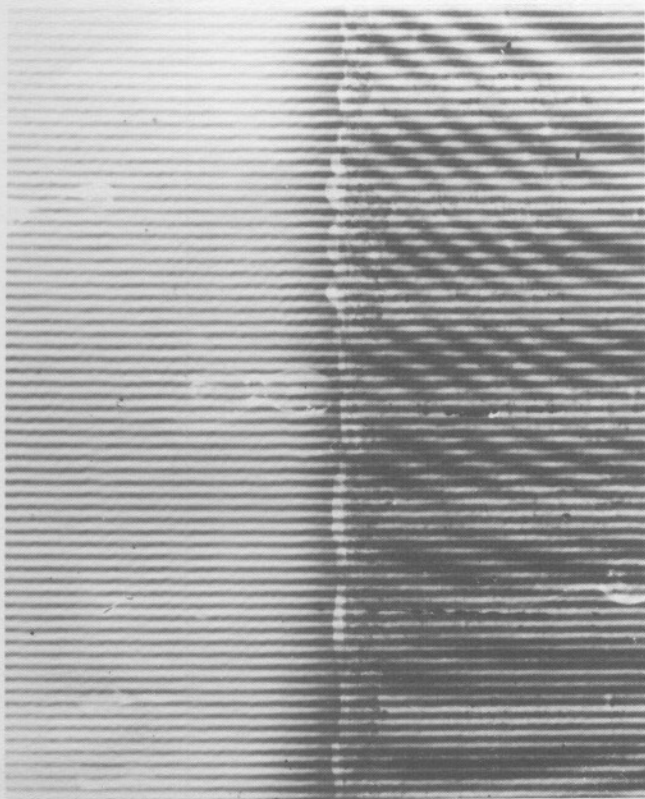


ANTIHALATION BACKINGS

Ed Wesly



Photograph by Ed Wesly

The left-hand side of this HOE was backed with #33; the right was not. Notice the random wood-grain pattern and the regular internal reflection ringing on the right.

Whenever light encounters the boundary between two different media, it is always reflected as well as refracted, except for the special case of polarized light incident at Brewster's angle. This *Fresnel reflection* depends on the difference of the refractive indices of the two media and the angle of incidence of the light. (See *Optics Guide 3* by Melles Griot, pages 174-175, for details.) Fresnel reflection occurs not only for light entering the glass, but also for light exiting the glass into the air. This internal reflection from the back boundary becomes a nuisance when it meets up with light

entering the first surface — the waves interfere, causing the familiar "wood grain" pattern to appear in the developed plate. Bleaching back to transparency can hide this cosmetic noise, but it would be nice to eliminate it at the source. How can a barrier be put inside a piece of glass to prevent light from returning from the back side?

Because photographic light sources are usually not coherent, photographers do not have to deal with that moiré wood-grain pattern, but they face a similar problem. Internal reflections can cause sources of light to look as if they have halos around them, so antihalation backings are added to the film to improve image sharpness.

Antihalation backings have the same (or nearly the same) refractive index as the glass or film substrate in order to effectively couple the exiting light. If there is no change of refractive index, then there is no Fresnel reflection and all the light proceeds as if it were still in the substrate. The backing should also absorb the light sufficiently to avoid light reflecting from the antihalation layer/air boundary. The layer need

not be too dark, since it does double duty attenuating light heading for the exit boundary and extinguishing whatever little bit is reflected on the pass back through the antihalation layer. Black would be a good panchromatic absorber, while blue, green or cyan would be effective for red lasers. Kodak is currently the only manufacturer of backed films and plates. At an informal poll taken at the 1985 International Symposium on Display Holography, an almost unanimous show of hands should have proved to the Agfa reps that there is a demand for 8E75 HD films and plates with backing, which they discontinued with the introduction of the HD series of emulsions in 1979.

There are various homemade antihalation solutions. A piece of black paper or cloth placed behind the plate is not a very satisfactory antihalation backing since it is neither of the same refractive index as the glass nor is it in intimate contact with it. Sometimes single-beam reflection images of the card can be seen in the final hologram. John Perry of Holographics North in Vermont uses black Speedball Screen Print Ink not only as an antihalation backing but also as an adhesive to attach the film to glass. But this creates quite a mess when washing off the ink, which should not touch the gelatin because it likes to stay there. Working with it in the dark requires a lot of care.

Black water-soluble hair spray like that sold in novelty and costume shops seemed like a good solution to me, but the hair spray wouldn't stick to the glass very well and ran like crazy. Paints, greases and index-matching tanks have been tried, but a solution that is easy,

cheap, effective and fun to use has been suggested by Doris Vila of the Art Institute of Chicago. You know what a thrill it is to strip the plastic protective coating off a fresh front-surface mirror with a piece of tape—this same coating works well as an antihalation backing! (Incidentally, I know of a Ph.D. candidate and his professor who didn't know this freshman trick and attacked the skin of the mirror with a variety of solvents and French curses!) The stuff is known as #33 Metal Blocking Spray and is available from Universal Photonics Inc. (495 West John Street, Hicksville, New York 11801; phone: 1-800-645-7173). Besides coating optics, it can also be used in layout work on metal, so similar products from the machine shop may also work.

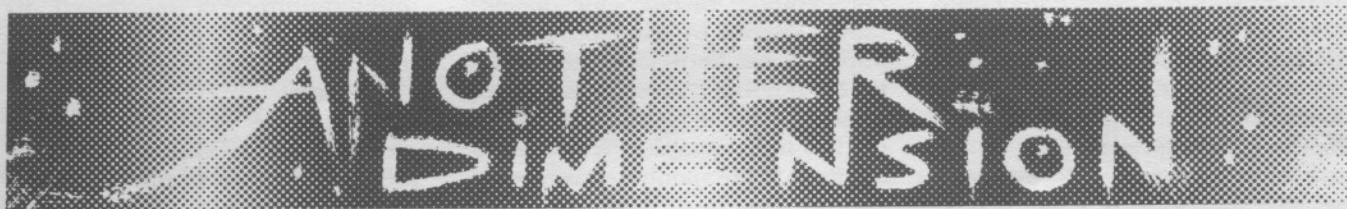
Lacking a refractometer to see how well #33 index matches glass, or a densitometer to check its

absorbency, other means of evaluation were required. A simple test of effectiveness for any antihalation backing is to look for fringes in the light reflected from a backed plate onto a white card. No fringes mean that light is being reflected only from the first surface, and that also suggests the use of the glass as a weakly reflecting "black mirror" to lower the ratio in a single-beam transmission setup with the reference mirror near to the object. The most practical test is to make a hologram on a plate that is only half backed. The photograph shows the wood-grain pattern superimposed on a rather low spatial frequency grating on the uncoated side of such a plate.

Spray the #33 on in a well-ventilated area or under a fume hood. The plates should be lying on a flat, absorbent surface so that any runs will be wicked off and soaked up before leaking under and spoiling

the emulsion. Accidents can be pulled off with tape, but it's best to prevent this, since the spray seems to desensitize the emulsion. A couple of "dry" sprays from afar are better than one done closer, which may turn thick and runny. A bonus of spraying is that the edges of the plate will be covered, so taping them is unnecessary to prevent that dreaded internal reflection ringing. The liquid can also be used to attach film to glass; however, don't spray directly onto a piece of acetate film, since a mild solvent action will distort it.

The improvement in the image is certainly worth the effort, but the easiest solution would be to be able to buy plates and film already AH'd. Now all we need is for someone to find a cheap, clear, nonflammable, nontoxic liquid for attaching film to glass for making reflection holograms.



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