The author notes that, in his initial experiments, the Kodak 120-02 plates were exposed to give a postdevelopment optical density of about four. Under the experimental conditions described, we can expect nearly 100% density modulation.

If we assume that the photometric equivalent of the Kodak 120-02 emulsion does not differ greatly from that of the 10E75 emulsion we studied, which is likely, it follows from our measurements that the phase changes within the 120-02 emulsion may well have exceeded 7 rad. This suggests that the plates were highly overexposed, since optimum results should be obtained for $\Delta\phi = \pi$ in the case of dielectric volume holograms, and for $\Delta\phi = 1.8$ in the case of dielectric thin holograms.

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Time response of NBS windowless XUV radiometric transfer standard detectors

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The National Bureau of Standards supplies calibrated vacuum uv radiometric standard detectors covering the 200–2537-Å region.[1,2] For the 200–1200-Å spectral region, the detector used is a windowless photodiode with a 2.5-cm diam cathode made of evaporated aluminum on whose surface a 150-Å thick Al_2O_3 layer has been anodized. Since considerable interest has been expressed in the use of these detectors with pulsed sources, a study has been made of the response of these diodes to pulsed radiation.

A Garton-type flashlamp[3,4] was modified to provide pulses of radiation with a duration of about 1 μsec. These pulses were passed through a half-meter Seya-Namioka vacuum monochromator, and the zero-order radiation was allowed to fall on the cathode of the diode. The emitted cathode current of the diode across a 50-Ω load was displayed by an oscilloscope. The oscilloscope was triggered by the voltage pulse that triggers the flashlamp. A potential difference of 90 V was maintained across the diode.

Output pulses were observed with instantaneous amplitudes as high as 1 mA with no evidence of saturation. The rise time of the diode output pulses was on the order of 300 nsec, which was the expected rise time of the flashlamp. To confirm that the rise time was flashlamp-limited, a diode with a tungsten cathode was substituted for the Al_2O_3 diode. A solid metal cathode is expected to have a faster response than a dielectric cathode. The temporal results were identical. Thus we are able to conclude that the NBS windowless Al_2O_3 radiometric transfer standard diodes have a rise time shorter than 300 nsec.

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Optical measurements of liquid film profile and dynamic contact angle

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A schlieren system using lenses and a graded filter was used to measure film profile and contact angle (the angle a liquid surface makes with a solid surface) upstream of dry patches, formed by heating, in a thin liquid film (about 1 mm) flowing down a vertical plate. The contact angle was measured under actual film breakup conditions, and the variation in contact angle with time was determined. The occurrence and stability of dry patches formed on a heated surface are of great practical significance, for, in some cases, loss of liquid cooling allows the surface temperature to exceed its melting point. This is particularly undesirable in a high heat flux, two-phase system such as the core of a boiling-water-cooled nuclear reactor.

Experiments were done in a film of liquid carbon dioxide draining down a glass plate on which a transparent heating film had been deposited. The liquid flow rate was set, and heat flux increased until the film broke up and dry patches formed. The formation of these dry patches was recorded on movie film at 2500 frames/sec.

The basis of the measuring system is the refraction of light at the curved surface upstream of the dry patch (Fig. 1). The slope θ of the liquid surface can be related to the deflection angle α using Snell's law to give

$$\frac{dy}{dx} = \frac{n_2/n_1 \sin\alpha}{1 - n_2/n_1 \cos\alpha}. \tag{1}$$

The angle α is related to optical density at the film plane by

$$\alpha = \tan^{-1}B(I - I_o),$$

where B is a system constant depending on the setup, I is the intensity corresponding to the refracted beam passing through the liquid, and I_o is the intensity corresponding to the undeflected beam passing the dry portion of the plate. Equation (1) then becomes

$$\frac{dy}{dx} = \frac{n_2/n_1 \sin[\tan^{-1}B(I - I_o)]}{1 - n_2/n_1 \cos[\tan^{-1}B(I - I_o)]}, \tag{2}$$

and this can be used to calculate the slope of the liquid surface if B is known and $I - I_o$ is measured.

A graded filter, instead of the more usual knife edge, was used to relate the deflection angle α to intensity, since fairly large deflections were expected at the liquid surface. Optical density differences at the film plane, $I - I_o$, were measured with a Joyce-Loebl microdensitometer, and surface slopes at different positions from the edge of the dry patch were calculated with Eq. (2). The slope was integrated numerically to find surface profile.

The system constant B is fixed by the light source (a laser was used to provide the high intensity necessary for high speed movies), the lenses used, and the physical setup. A section of a lens whose surface profile was carefully measured was attached to the heated glass plate so a portion of the incident light beam passed through and below it. Thus intensity difference corresponding to a known slope is known at all positions, and B can be found.

Figure 2 shows typical liquid film profiles upstream of an