crystals with dimensions of several millimeters were cleaved from these ingots. The cleaved slices were transparent, pale yellow in color, and about 1 mm thick. Optical and electrooptical effects observed were visible luminescence at 77°K under uv excitation, photoconductivity, and photovoltaic effects. The photoconductive and photovoltaic measurements were made on unetched, unpolished slices using indium and/or silver electrodes. The dark resistivity value determined from the dimensions of the crystal and from the voltage-current relations at room temperature was 10^8 Ω-cm along the C axis, and 10^6 Ω-cm perpendicular to it.

Photoconductive measurements were made using crystals with indium contacts soldered to sides parallel to the C axis. The experimental arrangement is shown schematically in Fig. 2. A typical room temperature photoconductive spectral response for constant irradiant power on the detector is shown in Fig. 3 (curve A). The constant irradiant power was maintained by varying the slit width with wavelength. At the peak of the response curve the resolution was 80 Å. The room temperature noise equivalent power (NEP) at 0.534μ was 5.3×10^{-10} W. The photoconductive response at 77°K is shown in curve B of Fig. 3. These results are qualitatively like those obtained with water grown crystals.[1] If a linear relationship is assumed between the position of the peak response and the temperature, the slope would be 1.32 Å/°C. The photoconductive time constant was 1 msec. This value was obtained by measuring the frequency dependence of the signal voltage.

Photovoltaic elements were made with both evaporated indium and with silver contacts on a crystal. In order to isolate the voltage due to a given contact, a cell geometry similar to that used by Fabricius[2] was employed (see inset Fig. 4). The semitransparent electrode had a transmission of about 60% and was evaporated onto a face perpendicular to the C axis. The experimental arrangement was the same as for the photoconductive measurements except that no bias was used, and the electrometer was operated as an impedance matching amplifier. The room temperature spectral response is shown in Fig. 4, and is seen to be quite similar to the photoconductive response. The photovoltaic peak occurs at 0.531μ, where the NEP was 7.2×10^{-10} W.

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A Screenless Integrating Sphere

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Received 22 March 1967.

Integrating spheres seem to be the best available diffusers and are practically mandatory when near-perfect diffuse radiation is required, as in densitometry.[1] Besides the wall of the exit port, the major sources of nonuniformity are due to the necessity of introducing radiation into the sphere. This requires an entrance port and, usually, a focal spot on the opposite side of the sphere. Both represent nonuniformities in the sphere wall luminance and, therefore, must be shielded from the exit port. The required shielding screens are, at best, inconvenient. In the present communication, a method is proposed for constructing a diffusing sphere requiring no screens.

It has been suggested[2] that the use of an opal glass window at the entrance port would permit the introduction of a greater amount of diffuse flux with a limited entrance port diameter. It would also eliminate the focal spot. We show that, with this method, the proper choice of port area yields a window luminance identical to that of the sphere wall.

When the exit port is small compared with the sphere diameter the sphere wall emittance is[3]

$$M = [\rho/(1 - \rho)]\Phi/4\pi r^2,$$

where ρ is the sphere reflectance, Φ is the total entering flux, and r is the sphere radius.

At the entrance port, the emittance is somewhat lower because of the lower reflectivity of the window ρ_w, but higher owing to the entering flux. It may be written

$$M_w = \frac{\rho_w}{1 - \rho} \frac{\Phi}{4\pi r^2} + \frac{\Phi}{A_w} = \frac{\Phi}{\pi}\left[\frac{1}{r_w^2} + \frac{\rho_w}{4(1 - \rho)r^2}\right].$$

where A_w, r_w are the window area and radius, respectively. The excess emittance at the entrance window is, then,

$$\Delta M = M_w - M = \frac{\Phi}{\pi}\left[\frac{1}{r_w^2} - \frac{\rho - \rho_w}{4(1 - \rho)r^2}\right].$$

This excess luminance vanishes when $r/r_w = [(\rho - \rho_w)/4(1 - \rho)]^{1/2}$.

Unfortunately, this expression will lead to the desired large ratio only for very small values of $1 - \rho$. However, values of $\rho = 0.995$ have been measured.[4] With this value, and $\rho_w = 0.53$, the required ratio is $r/r_w = 4.617$, which makes the port area $\frac{1}{2}$ of the sphere area.

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Use of Cer-Vit Material in Low Expansion Reference Optical Cavities

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Received 1 March 1967.

Passive optical cavities have been employed as sensitive discriminators in fast response laser frequency control systems. The frequency stability of the laser is then determined by the stability of the reference cavity. If the cavity is mechanically rigid and well shielded from ambient pressure disturbances, the short term stability of the laser can be very high (better than 1 part in 10^{10}); however, the long term stability is limited by the thermal expansion of the reference cavity spacer. The long term frequency stability, $\Delta\nu/\nu$, is given by $\Delta\nu/\nu = \alpha\Delta T$, where α is the spacer expansion coefficient and ΔT is the variation in spacer temperature. In order to achieve a stability of 1 part in 10^9 with a fused silica spacer ($\alpha = 5.7 \times 10^{-7}$), ΔT must be controlled to within ±0.0009°C. Cer-Vit, a low expansion material recently available from Owens-Illinois Glass Company, appears promising as a replacement for fused silica in this application. According to