SiO2-Si film-substrate reflection polarizers for different mercury spectral lines

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In this Letter, we present data on SiO$_2$–Si film–substrate reflection polarizers designed to operate at different mercury spectral lines. We carried out the design at different wave-
Fig. 3. The unextinguished reflectances $R_s$ and $R_p$ at the polarizing angle for SiO$_2$-Si $p$- and $s$-suppressing reflection polarizers, respectively, as functions of the wavelength $\lambda$ (in angstroms).

lengths for the SiO$_2$-Si system. The procedure explained in Ref. 1 was used with $p = 0$ (for $p$-suppressing polarizers) and $p = \infty$ (for $s$-suppressing polarizers). The chosen wavelengths are the spectral lines of mercury: $\lambda = 2537$ Å, 3131 Å, 3341 Å, 3650 Å, 4046 Å, 4358 Å, and 5461 Å; and the He–Ne laser light of $\lambda = 6328$ Å. The optical properties of SiO$_2$ and Si are 1.50, 1.487, 1.48, 1.475, 1.47, 1.46, 1.45, and 1.46; (1.67, 1.32), (4.90, 1.30), (5.06, 1.24), (6.63, 1.03), (5.63, 0.29), (4.83, 0.116), (4.07, 0.033), and (3.85, 0.02), respectively.

The results are shown graphically in Figs. 1–3. Figure 1 shows the dependence of the least polarizing film thickness on the wavelength for $p$- and $s$ suppressive polarizers. It is clear that the least polarizing film thickness increases monotonically with the wavelength for both kinds of polarizers. The polarizing angle for both kinds of polarizers does not show a similar monotonic behavior with the wavelength (Fig. 2). Figure 3 shows the unextinguished reflectance as a function of wavelength for the two kinds of polarizers. It is clear that better polarizers (with higher values of the unextinguished reflectance component) are obtainable at smaller wavelengths, where the extinction coefficient is larger.

A look at the $\phi-\lambda$ curve, Fig. 2, shows that the difference ($\phi_p - \phi_s$) decreases with the wavelength in certain regions of $\lambda$, so we expect the difference to approach zero by the appropriate choice of materials. By adding the appropriate multiple of the film-thickness period $D_{0.5}$ to the least polarizing film thickness $d_{0.5}$, we obtain a film thickness at which the film–substrate system acts as a reflection $p$-suppressing polarizer at $\phi_p$ and as a reflection $s$-suppressing polarizer at $\phi_s$. It is interesting to note that the condition $\phi_p - \phi_s = 0^\circ$ leads to a nonreflecting film–substrate system.

References
2. Tables of exact design parameters are available from the authors.

Polarization flipper for infrared laser beams: comment

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In a recent Letter1 Chrplyvvy described a system of five mirrors capable of flipping the plane of polarization of laser beams by $90^\circ$. The purpose of this Letter is to point out that a similar property is possessed by the prism described by Klein2 for use in $X$–$Y$ scanning systems. This was brought to my attention by Treacy,3 who also commented on the use of this property in the construction of a four-pass amplifier.4 The system described in Ref. 2 employs two mirrors and a prism with three internally reflecting faces, while that in Ref. 4 employs a prism with four internally reflecting faces. Chrplyvvy6 comments on the disadvantages of prisms in the far ir, owing to transparency limitations of materials and reflection losses at entrance and exit faces. However, these problems are avoided by using mirrors, instead of prisms, arranged in the same orientations as the prism faces. What we then have are several alternative mirror systems for use as polarization flippers, the choice between them being governed by ease of construction and convenience of adjustment.

References
5. A. R. Chrplyvvy, Cornell University; private communication (1976).

Laser-Electrooptic Technology Curriculum

Over the next five years there should be over 500 jobs in New Jersey available for laser-electrooptic technicians with two-year college degrees. Graduates of the program will be prepared for immediate employment or can continue their education in a four-year college or university. Graduates of the Camden County College program will earn an Associate in Applied Science degree. Applications are now being accepted for enrollment in the program at Blackwood, N.J. 08012. For more information call Diane Holtzman, 609-227-7200 ext. 363.