REFLECTORS AND POLARIZERS FOR THE VACUUM ULTRAVIOLET

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The reflectance of aluminium films has been determined with films free of contaminating layers (Feuerbacher and Steinmann, 1969.) It has been shown that the reflectance of smooth aluminium films is 91% at the Lyα line. The influence of the surface plasmon excitation has also been investigated. This shows up as a dip in the reflectance if the film is not perfectly smooth. It imposes stringent requirements on the polishing of mirror substrates if optimum reflectance is required in the 1200–1700 Å region, since the influence of the surface plasmon is caused by surface roughness of lateral dimensions less than 1000 Å.

The use of ultrahigh vacuum in the overcoating of these aluminium films results in a considerable improvement in total reflectance (Feuerbacher *et al.*, 1969). Overcoating with MgF_2 yielded films of 90% reflectance for wavelengths longer than 1250 Å, an improvement of about 10% relative to the best curve previously published. Films overcoated with LiF showed a reflectance of more than 90% for wavelengths longer than 1350 Å, while for shorter wavelengths the reflectance dropped to about 75%. It could be shown that the drop in reflectance was due to a change in the optical properties of evaporated LiF as compared to bulk samples. By proper annealing a reflectance of more than 80% was achieved for wavelengths longer than about 1020 Å.

A narrow band detector of polarized UV radiation was developed from a study of the bulk plasma resonance in thin films of Mg, Cd, and Zn (Feuerbacher and Fitton, 1970). The decay of the plasmons in such metals leads to the emission of photoelectrons since the plasmon energy exceeds the work function. The plasmon can only be excited by *p*-polarized radiation. Therefore this effect can be used to detect polarized UV radiation in a wavelength band around the plasma frequency. Magnesium films of 50 Å thickness showed a photoelectric response 23 times higher in *p*-polarized light than in *s*-polarized light, corresponding to a polarization of 0.92, in a wavelength band of 150 Å halfwidth centered at 1214 Å. The yield per incident photon is about 3% at the resonance maximum.

References

Feuerbacher, B. and Fitton, B.: 1970, *Phys. Rev. Letters* **24**, 499.
Feuerbacher, B., Fitton, B., and Steinmann, W.: 1969, *ELDO/ESRO Tech. Rev.* **1**, 385.
Feuerbacher, B. and Steinmann, W.: 1969, *Opt. Commun.* **1**, 81.

DISCUSSION

A. Title: What is good vacuum?

B. Feuerbacher: The evaporation has been performed in a vacuum of some 10^{-10} Torr. The vacuum should be such that the evaporation time is short compared to the monolayer time.

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