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$$\begin{bmatrix} e_{xx}' & & \\ & e_{yy}' & \\ & & e_{zz}' \end{bmatrix}. \quad (1$$

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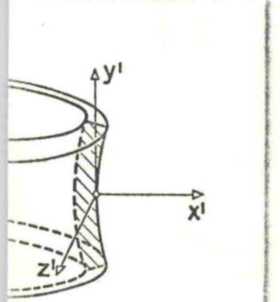

ing the ends of a previousl
section. The stress axis is z'.

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stress tensor given by (1), we found the agreement ween the measured and calculated ratio to be better an 3%, provided the condition $|e_{zz}'| \leq 4d^2/b^2$ was illed. In the optical measurements on Cu crystals, pical numbers were $|e_{zz}'| = 4\times10^{-4}$, $4d^2/b^2 = 0.4$. hus the above condition was always met.

In the actual measurements, the crystal forms a all segment of the ring shown in Fig. 2; the distorns produced by the clamps cannot always be ne cted. Measurements of ρ_1 and ρ_2 of large aluminum rs clamped at the ends in a way similar to that own in Fig. 1 were carried out. The difference be een the calculated and the measured $|e_{zz}'/e_{yy}'|$ at e midpoint of the sample was again below 3%, pro led the free length of the sample (Fig. 1) was at st twice its width. Typical values for the Cu crystals ed in the optical experiments are $l = 10$ mm, $b = 3$ mm, e., this condition was also fulfilled.

Figure 3 shows the arrangement to determine the omponent e_{zz}' of the strain tensor by measurement of e focal length of the cylindrical mirror, formed by e bent sample. The sample was oscillating, and the equency of the stroboscope was tuned close to the esonance frequency of the sample. The distance be een the sample and the image of the slit changed riodically with the difference frequency ω(stroboscope)$-\omega$(sample). The amplitude of the strain at the urface is given by

$$e_{zz}' = \Delta ad(2a_0)^{-2}\{1+[1+(\Delta a/a_0)^2]^{1/2}\}^{-1}, \qquad (2)$$

here a_0 is the position of the image for zero strain and Δa is the difference in the position for maximum extension and compression. The accuracy of this method ncreases with decreasing distance between lens and sample. It was about ±5% for the geometry used ere. The components e_{xx}', e_{yy}' of the strain tensor are expressed in terms of the measured component e_{zz}' by means of the stress-strain relation using the form 1) of the stress tensor. The elastic constants are taken rom Ref. 20. Because of the sample dimensions hosen, the errors in e_{xx}' and e_{yy}' due to deviations rom (1) are smaller than 3%. During the optical measurement, the strain amplitude and phase was monitored by a pickup capacitor, consisting of one of the magnets at the ends of the lever arms (Fig. 1), moving against a fixed, insulated piece of sheet metal.

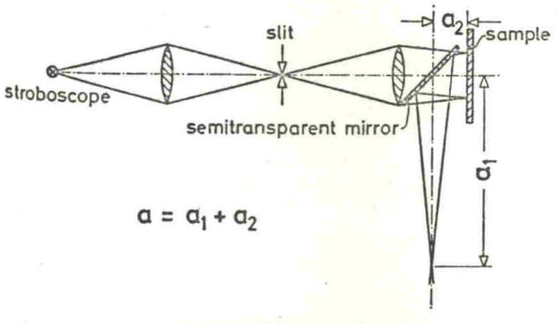

FIG. 3. The optical design which was used to determine the focal length of the cylindrical mirror formed by the bent sample.

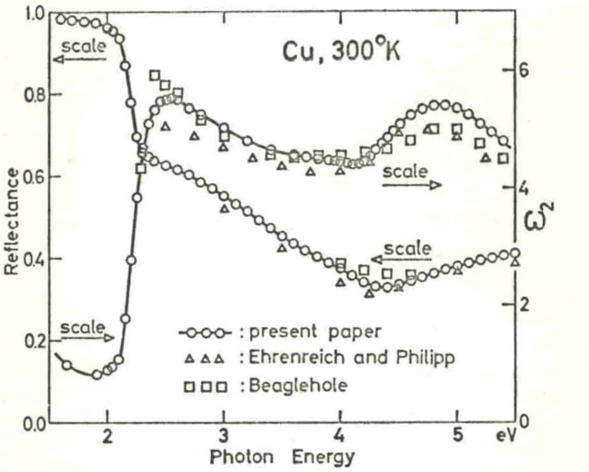

FIG. 4. The reflectance and ϵ_2, the imaginary part of the dielectric constant of Cu at room temperature. The values determined by Ehrenreich and Phillipp (see Ref. 18) and by Beaglehole (see Ref. 22) are only shown if they differ by more than 2% from the values given in the present paper.

Sample Preparation

The orientation of the samples cut from a single crystal was determined to within ±1° using Laue diagrams. The surface preparation consisted of grinding, mechanically polishing, and electropolishing[21] the sample. The electropolishing was terminated by quickly rinsing in deionized water and alcohol. After taking the sample from the alcohol bath, the thin film of alcohol at the surface was immediately removed by a warm stream of air. The reflectance of a freshly prepared sample, measured within 10 min after the electropolishing, is given in Fig. 4. The growth of an oxide layer at the surface of the sample is responsible for the observed decrease in the reflectance with time. This decrease is most pronounced in the ultraviolet. We observed a 1% decrease at 5.5 eV within 1 h after the electropolishing.

Although the reflectance of our samples was measured in air, it deviates less than 1% from the values determined by Beaglehole,[22] which were measured in a high vacuum after reducing the oxide layer at the surface. The only exception is the region around 4.3 eV. The resolution of the vacuum monochromator used by Beaglehole was not high enough to resolve finer details of the minimum at that energy[23] (see Fig. 4). Thus the oxide layer on our sample modifies the reflectance not more than 1% between 1.5 and 5.5 eV. The reflectance given by Ehrenreich and Philipp[18] is slightly lower

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[20] *American Institute of Physics Handbook* (McGraw-Hill Book Co., New York, 1957), Chap. 2, p. 56.

[21] W. J. Tegart, *The Electrolytic and Chemical Polishing of Metals* (Pergamon Press, Inc., New York, 1959), 2nd ed.

[22] D. Beaglehole, Proc. Phys. Soc. (London) **85**, 1007 (1965).

[23] D. Beaglehole (private communication).