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Author

Muller, Rolf H.

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University of California
Ernest O. Lawrence
Radiation Laboratory

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Berkeley, California

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A SIMPLE METHOD FOR DETECTING MICROVARIATIONS
IN THE SURFACES OF POLISHED FLAT MATERIALS

Rolf H. Muller

March 3, 1963

Discussion of
"A Simple Method for Detecting Microvariations in the Surfaces of
Polished Flat Materials," by M. V. Sullivan,
Electrochem, Technology 1, 51 (1963).

Rolf H. Muller

Inorganic Materials Research Division
Lawrence Radiation Laboratory
University of California
Berkeley, California

March 3, 1963

The arrangement employed by Dr. Sullivan for the observation of flat, polished surfaces in the paper, "A Simple Method for Detecting Microvariations in the Surfaces of Polished Flat Materials," is one of many possible variations of Schlieren - Optical techniques where small angle light deflections in the object are observed as intensity variations in the image. Here, the deviations from flatness in the mirror surface take the place of the light-deflecting refractive index variations in a transparent object. In contrast to interferometric methods, Schlieren techniques are sensitive to the slope, not the absolute magnitude of deviation from flatness. Thus, relatively small, localized indentations or protrusions will show up more prominently than a more gradual change, even if it extends over all larger depth.

Since the object A is not focussed by a lens on the image plane B the arrangement shown in Fig. 1 of the paper corresponds to a Schlieren technique without focussing of the object, also called Shadowgraph technique. In interpreting the pictures obtained it might be kept in mind that it is characteristic of shadowgraphs that only the darker-than-average areas in the image bear a geometrical relationship to the object, while the location of the lighter-than-average areas depends on such factors as the angle of deflection, the position of the deflecting areas with respect to each other and the distance between object and screen as can be derived from Fig. 1 of

the paper. The interpretation of Figs. 2b, 2d and 2f should therefore primarily be based on the dark patterns while the light patterns - although more noticeable - must be used with caution. Under certain conditions the light pattern is located immediately adjacent to the dark one and then bears some resemblance (although not a geometrical similarity) to the surface structure. Parts of Fig. 2f may be viewed this way.

Pictures for a more quantitative evaluation could be obtained by transforming the present arrangement into a Schlieren technique (e.g. of the Toepler type) with focussing of the object. There, the brightness of the picture is a direct measure of the slope of the surface deviating from flatness. Details for such a modification may be found in the authoritative review by H. Schardin in *Ergebn. exakt. Naturwiss.* 20, 303 (Springer 1942).

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