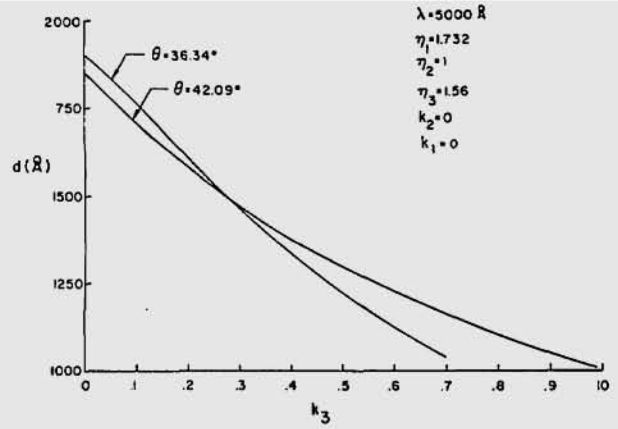

Fig. 2. Soot isoreflectance plot.

$$d = -\frac{\lambda}{(RE)4\pi n_{12}} \ln \left[\frac{-b + (b^2 - 4qc)^{1/2}}{2q}\right], \quad (3)$$

in which

$$q = [R - (x_1{}^2 + y_1{}^2)],$$

$$b = [2R(x_1x_3 - y_1y_3) - 2(x_1x_3 + y_1y_3)],$$

and

$$c = [R(x_1{}^2 + y_1{}^2)(x_3{}^2 + y_3{}^2) - (x_3{}^2 + y_3{}^2)].$$

Two reflectance measurements at angles close to but above the critical angle are made. The intersection of the two isoreflectance curves, d as a function of K_3, yields the value of K_3.

Measurements of acetylene soot were made by using a Cary 14 dual beam spectrometer equipped with a Wilks ATR double prism attachment. The soot was deposited by coating the fixed prism with a mixture of soot and proponal and allowing the proponal to evaporate. Reflectance measurements were made at $\theta = 36.3°$ and $42.1°$. Dalzell's[8] value, $n = 1.56$, for soot was used.

To illustrate the validity of the model, Fig. 2 shows the isoreflectance curves, $d = d(K_3)$, for the two reflectance measurements for $\lambda = 500.0$ nm. The intersection of the two curves, $\theta = 36.3°$ and $\theta = 42.1°$, gives a value for the attenuation index almost the same as Dalzell's: $K_3 = 0.29$. As further evidence of the advantage of the model, if the single-layer equations are used,[3] one obtains $K_3 = 0.04 \pm 0.01$, which is obviously incorrect for soot.

By the use of this FTR technique, some of the present uncertainty in K values for atmospheric aerosols should be resolved.

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Surface plasma oscillations at sinusoidal silver surfaces

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Received 2 April 1977.

We measured the propagation velocity and the damping of surface plasma oscillations (SPOs) at sinusoidally corrugated silver surfaces and compared the results with those of the smooth surface. The experimental data are in good agreement with theoretical considerations.

Using ATR-methods (attenuated total reflection) it was observed recently that the properties of SPOs propagating along the silver–air boundary of thin silver films ($d_{Ag} \approx 600$ Å) were changed by statistically distributed[1,2] as well as periodical surface roughness[3]: Qualitatively we have observed a shift of the phase velocity of the SPO to smaller and of the damping to higher values with increasing roughness. Only for periodical (sinusoidal) surface corrugation is quantitative comparison between experimental and theoretical results practical,[4] because only in this case is it possible to determine experimentally the characteristic parameters of the surface modulation (grating constant a and groove depth h; h is defined as half the peak-to-peak value of the modulation). Evaluating the experimental result of ATR measurements for sinusoidal corrugations, one has to take care of the possible coupling of SPOs excited at both sides of the thin silver film,[5] and of the influence of the finite silver thickness on the damping, and, to a smaller degree, on the phase velocity of the SPO.
thickness in an ATR arrangement, we investigated the properties of SPOs propagating along a sinusoidally corrugated boundary between an air and a silver half-space. Using p polarized incident light, the SPOs can be excited by grating coupling in this experiment.[6] We got the damping and the phase velocity of the SPO by evaluating the SPO-resonance anomalies in the reflected light intensity: exciting SPOs by the +1 diffraction order of the grating the propagation velocity v_x and the damping $k_{1/2}$ are connected with the angle position Θ_0 and the half-width $\Theta_{1/2}$ of the resonance minimum by

$$k_x{}^{SPO} = (2\pi)/\lambda \cdot \sin\Theta_0 + (2\pi)/a; \; v_x{}^{SPO} = (2\pi c)/(\lambda \cdot k_x{}^{SPO}),$$

$$k_{1/2}{}^{SPO} = (2\pi)/\lambda \cdot (\cos\Theta) \cdot \Theta_{1/2},$$

where $k_x{}^{SPO}$ is the wavevector of the SPO and λ the wavelength of the incident light.

The investigated gratings were prepared with holographic methods in photoresist layers which were overcoated with silver of sufficient thickness by vacuum evaporation.[5]

Figures 1(a) and 1(b) show the influence of the groove depth h on the resonance angle Θ_0 and the half-width $\Theta_{1/2}$ for three wavelengths of the incident light: $\lambda = 5682$ Å, 5145 Å, and 4579 Å. The measurements demonstrate the expected increase of Θ_0 and $\Theta_{1/2}$ with h.[6,7]

The curves give theoretical results assuming an exact sinusoidal surface profile, where we have used the experimentally determined grating constant $a = 6015$ Å and dielectric function $\epsilon_{Ag} = \epsilon_r + j\epsilon_i$ of our silver layers.

The full line represents the result of the exact integral formalism developed by Maystre,[8] the dashed line that of the

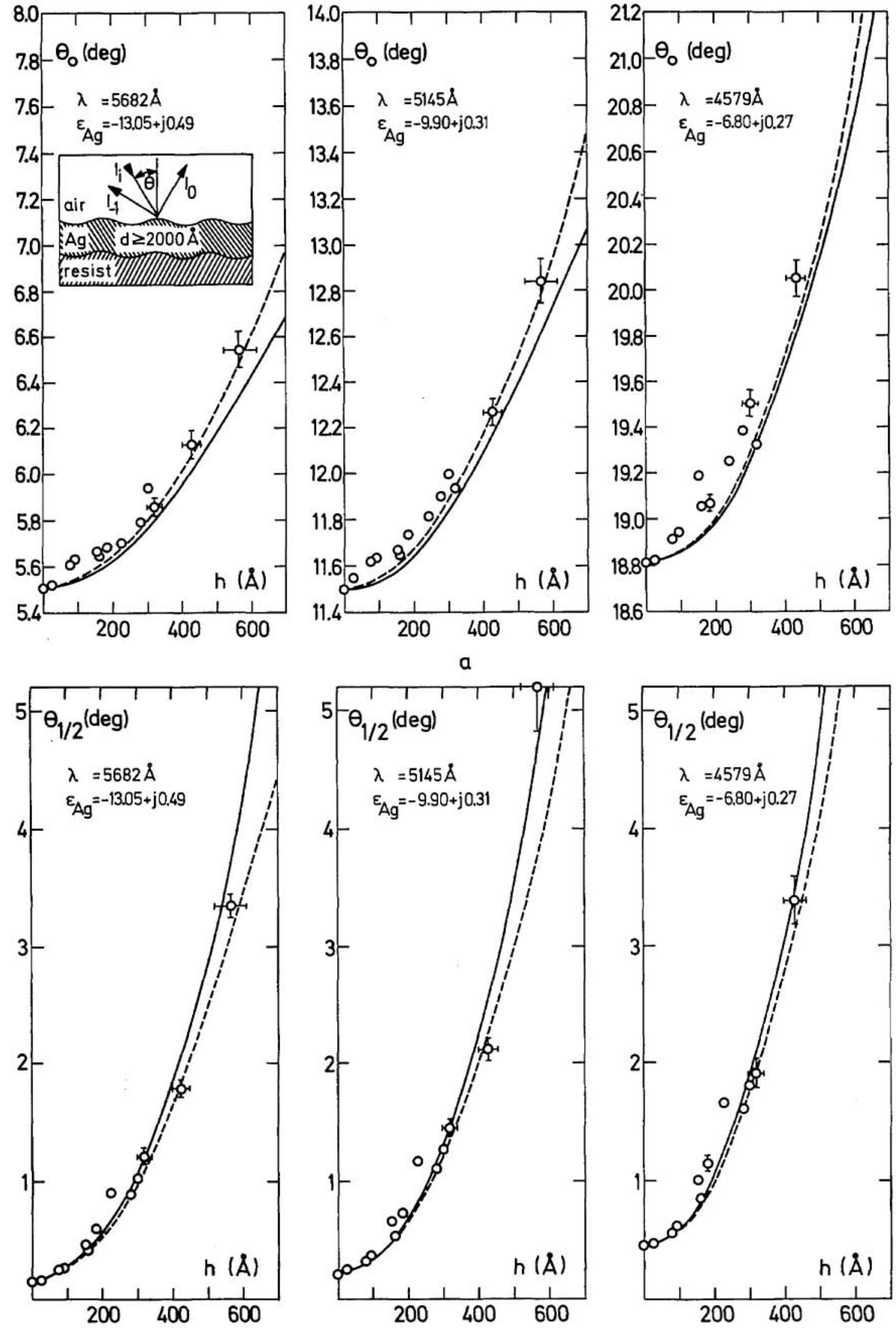

Fig. 1. Influence of the groove depth h of a sinusoidal silver grating on the resonance angle Θ_0 (a) and the half-width $\Theta_{1/2}$ (b) of the SPO resonance anomaly. Dots are experimental measurements; curves are calculated from theories by Maystre[8] (solid line) and Kröger and Kretschmann[7] (dashed line).

perturbation approach by Kröger and Kretschmann.[7] We found good agreement between experiment and theory *without fitting* any unknown parameter of the investigated system to the experimental results.

The described measurements quantitatively show the strong dependence of SPO properties on surface corrugation parameters; this influence also should be observable for smaller grating constants <1000 Å, if h/a has the same order of magnitude as in the results described above. This is of importance for the interpretation of experimental results on statistical rough surfaces which contain these short periods.[9]

The authors gratefully acknowledge D. Maystre for the calculation of theoretical data with his integral formalism. Maystre is with the Laboratoire d'Optique Electromagnétique, Faculté des Sciences et Technique de St.-Jérôme, 13397 Marseille Cedex 4 (Equipe de Recherche Associée au C.N.R.S.).

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Absolute radiometric measurements of the emission from a BRV source at 34 nm

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Received 7 February 1977.

We report measurements of the time integrated spectral intensity near 34 nm of a BRV source of emission continuum[1–3] as modified by Garton *et al.*[4] Cantù and Tondello[5] have improved the performance of the BRV source beyond that of the source used for this work by adding a cylindrical cap at the end of the anode and by increasing the discharge energy.[6]

For the present measurements the vacuum spark was derived from a capacitor of 0.5 μF charged to 18 kV. The uranium anode had a diameter of 3.2 mm, and the electrode gap was 4 mm. Two aluminum foil filters (150-nm thickness) were placed between the BRV source and an aperture that defined the collecting area of 0.30 cm^2. This aperture was centered on the anode-to-cathode axis, 40 cm from the anode. The cathode of a tungsten diode intercepted all the radiation that passed through the aperture. The anode potential was

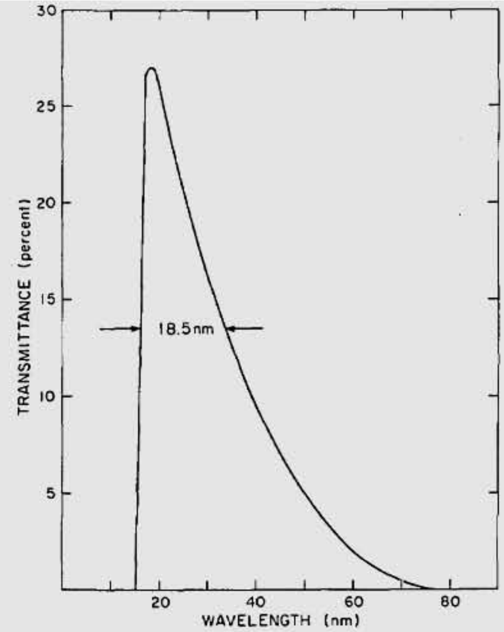

Fig. 1. The transmittance (in percent) of the combined aluminum filters is given as a function of wavelength.

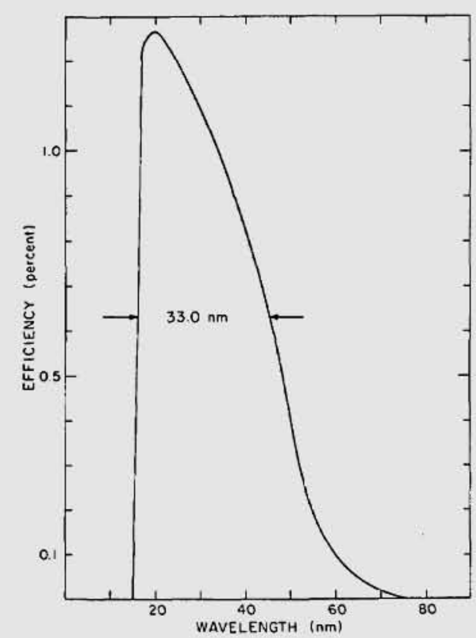

Fig. 2. The percent efficiency (electrons per photon) of the calibration system is given as a function of wavelength.

+90 V. The time integrated current to the cathode was measured with a Keithley electrometer in the charge mode. The charge was measured after each firing of the source. The pressure in the source and in the diode was less than 4×10^{-6} Torr.

Prior to the radiometric measurements, the quality of the emission continuum was checked photographically with Kodak 101-01 film and a 3-m McPherson spectrograph equipped with a gold-coated grating used in normal incidence.