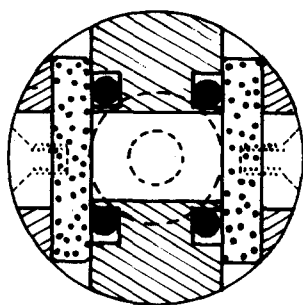


FIG. 1. High pressure optical absorption cell.



mitted to the liquid in the cell by the movement of the glass plunger.¹

To make such a cell out of silica for measurement in the uv region is difficult and we therefore developed a small stainless steel cell which can be used inside a 10 kbar bomb fitted with 12.7 mm thick, 6 mm aperture sapphire windows.² Details of the cell are shown in Fig. 1. None of the dimensions are critical, but they are chosen so that the cell fills practically all the space in the high pressure bomb. The internal volume of the cell is kept as small as possible (approx. 1 cc) so that only a very small volume of liquid (approx. 3 cc) is compressed in the high pressure bomb and compression heating is thereby reduced to a minimum.

The distance between the windows of the cell is 8 mm, but the optical path can readily be reduced to 0.2 mm by inserting polished silica disks. The windows consist of 2 mm thick fused silica plates and are sealed to the cell by soft O-rings. The pressure is transmitted to the inside by a slightly tapered plug machined out of polyethylene as shown. This plug has a slight groove cut into it which

almost reaches to the top edge and which allows air to escape as the plug is inserted.

When the cell is used without spacers it is filled and cleaned from the top by means of a syringe, but when spacers are used it is found necessary to remove one window in order to clean the cell properly. When several disks are used to obtain very short optical paths it is often necessary to apply about 10 bar to the cell before all the spaces between the disks are filled with liquid.

Since there is no pressure difference between the inside and the outside of the cell the optical pathlength will change with pressure only to the extent of the compression of the stainless steel and this change will be quite negligible in the context of ordinary spectrophotometric measurements. It is of course necessary to correct measurements for absorption by the pressure medium and for lens effects in the pressure windows. This correction is found from blank measurements on pure solvent at the same wavelength and pressure.

¹ A. H. Ewald and S. D. Hamann, *Australian J. Chem.* **9**, 54 (1956).

² D. Langer and D. M. Warschauer, *Rev. Sci. Instr.* **32**, 32 (1951).

Two Simple Methods of Making Grainless Fluorescent Screens*

ALVAR P. WILSKA

Department of Physics, University of Arizona, Tucson, Arizona
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VIEWING screens for electron beams are usually made of fluorescent powders. Due to the particle size, the resolution is seldom better than 25μ . With grainless fluorescent screens, the resolution could be the same as that of the optical microscope. In order to be viewed under highest light-optical magnification, the fluorescent layer should be only a few tenths of a micron thick. Otherwise, some of the electrons, penetrating deeper, will cause fluorescence at distances for which the light microscope is not focused. However, the evaporation of thin layers of ordinary fluorescent materials¹ is difficult because of decomposition.

For light-optical reasons, the thin, grainless fluorescent layer should be attached to a transparent carrier of the thickness of a regular cover-glass used in light microscopy. An optimum thickness would be about 0.18 mm for which most of the light microscope objectives have been designed. This could be achieved by chemically treating a piece of cover-glass so that a thin fluorescent layer would form on its surface. Cover-glasses may be made of quartz and thus quartz could be used just as well as a substrate.

(1) A suspension of equal weights of ZnO and water containing a few parts per thousand of wetting agent Tween 20 and 1–2% of $MnCl_2$ is painted on a quartz sur-

face which, after drying, is held at a temperature of about 950°C for several minutes. After the crust is washed away, the completely clear and grainless surface layer shows a strong green fluorescence for electron beams. In order to double the amount of light and to prevent ion damage, a 1000 Å thick layer of Al is evaporated onto the treated surface. It is very likely that this treatment with Zn and Mn compounds has converted the surface of quartz into willemite, which is zinc silicate with manganese as an activator.

(2) A slurry of Cu₂O powder and water with some Tween 20 is painted on a glass surface. After drying and baking for 5–30 min at 250 to 350°C, the crust is removed with diluted HCl. An invisible layer of an unknown composition remains, having a strong white fluorescence.

This method gives good results on many types of ordinary glass, even on some used as specimen cover-glasses in light microscopy. Some types of glass, e.g., those of borosilicate type, do not give the desired result. The reasons for these differences have not yet been investigated.

The fluorescent layer is sensitive to ion bombardment and should be protected by evaporating a thin mirror layer of aluminum.

On both types of screens, shadow images of fine mesh grids appeared perfectly sharp at a light-optical magnification of 1000 times. Oil immersion objectives were used for the tests which were carried out at acceleration potentials of 4 to 20 kV.

* This investigation was supported by Public Health Service Research Grant No. 11852 from the National Institutes of Health.
¹M. von Ardenne, *Tabellen zur angewandten Physik* (Berlin, 1962), Vol. I, p. 181.

Method of Polishing Flat Metal Single Crystals

T. W. SNOUSE

Vehicle Environment Division, National Aeronautics and Space Administration, Ames Research Center, Moffett Field, California

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IN the course of sputtering research with copper single crystals, it was frequently necessary to repolish the bombarded area as well as remove several microns of material. This note describes how the acid polisher described by Young and Wilson¹ was modified to do both jobs in one step while avoiding the problem of shouldering.

The samples used were 1.9 to 2.5 cm diam copper single-crystal disks. The various polishing methods tried did not maintain a flat face on the disk, common defects being shouldering and uneven removal of material. The answer to this problem proved to be the use of the acid polisher as an electropolisher. The necessary changes are simple and do not affect the use of the device as an acid polisher. The plastic acid wheel is replaced by a stainless steel wheel.

TABLE I. Polishing parameters for 1.9 cm diam copper and aluminum disks.

Metal	Electrolyte	Sample speed, rpm	Polishing wheel speed, rpm	Current density, A/cm ²
Copper	dist. water, 500 cc	65	40	1.2
	ethyl alcohol, 250 cc			
	propyl alcohol, 50 cc			
	phosphoric acid, 250 cc			
urea, 3 g				
Aluminum	perchloric acid, 62 cc	65	40	0.2
	ethyl alcohol, 700 cc			
	butyl cellulose, 100 cc			
	dist. water, 137 cc			

The Teflon sample holder is made with a commutator and slip ring arrangement which makes electrical contact with the sample. The polishing wheel and the negative terminal of the electropolisher power supply are grounded, and the sample is maintained at a positive potential.

The sample and polishing wheel rotate in the same direction, and are brought close enough together that an electrolyte film fills the space between them. The polishing voltage is then gradually applied, and the sample-to-polishing-plate distance is simultaneously increased until the desired current density is achieved. The sample must be backed away from the polishing plate to avoid shouldering due to the field-induced increase in the amount of electrolyte between the plates.

Polishing times range from 2 to 5 min for the removal of 1 to 3 μ of material. The parameters for successful polishing of copper and aluminum are given in Table I. Standard polishing solutions with some changes in wheel speeds and current densities should make this polishing method feasible for most metals.

¹F. W. Young, Jr., and T. R. Wilson, *Rev. Sci. Instr.* **32**, 559 (1961).

Differential Amplifier for Use in a Potentiostat or Voltage Regulator

HOWARD H. ROGERS

Research Department, Rocketdyne, A Division of North American Aviation, Inc., Canoga Park, California

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THIS note describes a single stage differential amplifier (Fig. 1), which was designed to have high input impedance and high gain. It was intended for use in a wide range potentiostat with the following specifications: output voltage range 0 to 20 V, current range 10⁻⁶ to 10 A, maximum output impedance 10⁻³ Ω, maximum response time 10⁻³ sec, maximum input current (from a reference electrode) 3 × 10⁻⁹ A.

Although many examples of good potentiostat design are described in the literature,¹⁻³ a design meeting all the