The change of gauge sensitivity with temperature increase is found to be negative and very small; this change is probably explicable by small pressure changes due to thermal transpiration of the gas.
K J Close et al, *Vacuum*, **29** (617), 1979, 249–250.

22

4374. The use of an oscillating vane gauge to determine gas composition of binary gas mixtures. (GB)
A description is presented of a continuously driven oscillating vane gauge, which can be used to determine the composition of binary gas mixtures. Consideration is given to operation not only in the molecular and viscous pressure range but also in the intermediate 10–100 mtorr range. (Australia)
F H Dyksterhuis, *Vacuum*, **29** (4/5), 1979, 149–154.

23. PLUMBING, VACUUM VALVES, BAFFLES AND TRAPS

23

4375. Pressure-made soft-metal vacuum seals for glass and ceramics. (GB)
Indium and aluminum are used as soft-metal pressure sealants for glass-to-glass and glass-to-ceramic interfaces and, in addition, between a wide range of dissimilar materials having unlike thermal coefficients of expansion. The metals form a true seal, being molecularly bonded to the base materials and provide electrical conductivity through the vacuum enclosure. Aluminium seals are made just below the softening point of 'hard' glass.
R G Neuhauser, *Vacuum*, **29** (6/7), 1979, 231–235.

23

4376. Capillary array: a new type of window for the vacuum ultraviolet. (USA)
Experiments with optical radiation often require separation of a region of relatively high pressure from a lower-pressure region while allowing transmission of radiation between regions. When work is done with vacuum ultraviolet radiation (VUV), the problem is made more difficult by the small number of transparent materials, there being no bulk materials which transmit at shorter wavelengths than the 1050 Å cutoff of LiF. In this paper we report the successful use of glass capillary arrays combined with differential pumping to sustain large pressure differences with excellent transmission of radiation throughout the VUV region.
T B Lucatorto et al, *Appl Opt*, **18** (14), 1979, 2505–2509.

24. LEAK DETECTORS AND LEAK DETECTION

24

4377. The influence of virtual leaks on the pressure in high and ultra-high vacuum systems. (GB)
It is found that the least upper bound to the pressure in a vacuum system with a virtual leak is $Q_0/(et_0S)$. Where Q_0 (torr 0.1) is the quantity of gas trapped at $t = 0$, $e = 2.718$, $t_0(s)$ is the time from the start of the pumpdown and S (l s^{-1}) is the real pumping speed. (USA)
D Edwards Jr, *Vacuum*, **29** (4/5), 1979, 169–172.

25. HEATING EQUIPMENT AND THERMOMETERS

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4378. Temperature measurements on thin vapour-deposited films. (GB)
A method for precise temperature measurements on thin vapour-deposited films has been developed for magneto-optical Kerr studies of the critical magnetic behaviour of thin nickel films. The combination of a bulk platinum resistor and a thin-film Au–Pt thermocouple eliminates errors which usually occur if only one of these probes is used. The accuracy and stability of the method are determined by the resistor, whereas the thermocouple used as a zero indicator in a feedback circuit extends the applicability of the resistor to measurements on thin films. Local temperature changes down to 10^{-2} K can be measured reliably, e.g. at the film spot where a laser beam is reflected. (Germany)
S Schwarzl, *J Phys E: Sci Instrum*, **12** (5), 1979, 436–438.

III. Vacuum applications

30. EVAPORATION AND DEPOSITION *IN VACUO*

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4379. Thin film coatings: algorithms for the determination of reflectance and transmittance, and their derivatives. (USA)
The paper deals with the specular optical properties of thin dielectric or metallic multilayer coatings. Recurrent formulas are given for reflectance, transmittance, and their derivatives with respect to thicknesses, indices, incidence, and wavelength. Because of its simplicity and flexibility, the proposed method is particularly well fitted for use in a digital computer and for optimization programs. (France)
H Dupoisot and J Morizet, *Appl Opt*, **18** (15), 1979, 2701–2704.

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4380. Normal conductivity and superconductivity of an A1-type iodine phase. (GB)
A metallic A1-type iodine modification exhibiting soft superconductivity was quench-deposited on CaO or SrO. The normal resistivity, superconducting transition temperature and critical magnetic field decrease with increasing thickness. On heating, the ordinary non-metallic diatomic structure is restored. (Italy)
C Reale, *Vacuum*, **29** (617), 1979, 245–248.

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4381. Thin film optical coatings. 7. Two-layer coatings close to anti-reflection. (USA)
This paper examines the residual reflection of two-layer coatings close to antireflection. Residual reflection can be induced either by fluctuations or errors in the thickness of the layers. Fluctuations in thickness, resulting from insufficiently accurate measuring equipment, lead to the notions of stability and tolerances. When reflection is substantial, a method of calculation is proposed for determining thicknesses effectively deposited. (France)
J Mouchart et al, *Appl Opt*, **18** (8), 1979, 1226–1232.

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4382. Neutral density filters by co-evaporated Ag and SiO_2 films for near ir radiation. (USA)
Optical properties of Ag and SiO_2 co-evaporated films were studied in the visible and near ir regions, and a novel neutral density filter for near ir radiation has been proposed. The films, which contain 56 vol.% Ag, exhibit almost wavelength-independent optical transmittance in the longer than 1 μm wavelength region. Neutral density filters, which have desired optical transmittance, can be obtained by controlling the co-evaporated film thickness.
A Shibukawa, *Appl Opt*, **18** (9), 1979, 1460–1462.

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4383. Measurement of grain-boundary diffusion at low temperature by the surface-accumulation method. II. Results for gold–silver system. (USA)
Grain-boundary diffusion rates in the gold–silver system were measured at relatively low temperatures by the surface-accumulation method which was analysed in Part I. The specimen was a polycrystalline gold film possessing columnar grains on which a silver layer was initially deposited epitaxially on one surface. During subsequent low-temperature annealing lattice diffusion was frozen out, and diffusion then occurred along the grain boundary and free-surface short circuits. The silver, therefore, diffused into the film from the silver layer along the boundaries, eventually reaching the opposite surface where it accumulated and was measured by Auger spectroscopy. The silver layer acted as an effective constant silver source, and grain-boundary diffusivities were calculated from the accumulation data. However, the exact location of the effective constant source in the silver layer could not be determined and this led to an uncertainty in the values of the grain-boundary diffusivities of a factor of 10. Lower- and upper-bound values were therefore described by D_b(lower bound) $= 7.8 \times 10^{-6} \exp(-0.62eV/kT)$ and D_b(upper bound) $= 7.8 \times 10^{-5} \times \exp(-0.62eV/kT)\,\mathrm{cm^2\,s^{-1}}$ in the temperature range 30–269°C. An examination of available grain-boundary diffusion data (including the present) suggests a tendency for the observed activation energy to decrease with decreasing temperature, and this was ascribed to a spectrum of activated jumps in the grain boundary and/or a spectrum of boundary types in the specimen employed. The constant source behaviour was tentatively ascribed, at least in part, to a grain-boundary 'Kirkendall effect' resulting from the faster diffusion of silver than gold. The work