evaporated silver layers[2]. If the measurements published in these papers are taken into account, it is apparent that multilayer coatings are not superior, in the range of wave-lengths over which they have been investigated, to evaporated silver films of good quality.

The value $R = 0{\cdot}90$ does not represent the "useful upper limit" of the reflectivity of silver layers (as is stated by Jarrett). The direct measurements made with new layers by Kuhn and Wilson show that, for a transmissivity of 0·02, the reflectivity varies from 0·97 to 0·96, and the absorption from 0·01 to 0·02 over the range of wave-lengths from 6800 to 5200 A. The performance of these silver layers is thus slightly superior to that of Jarrett's multilayer coating, which was found to have a reflectivity of 0·97 and an absorption of 0·02 in this region. The reflectivity and absorption of silver films three weeks old are about the same as for multilayer films. Towards shorter wave-lengths the efficiency of both silver and dielectric films decreases, but not enough quantitative data for the latter are available to allow comparison.

In practice, very high reflectivities are not used with étalons, since the limiting factor to the resolving power is the accuracy of working of the surfaces of the plates. With plates of good quality, the errors are not substantially smaller than 1/50 fringe; and since a reflectivity of 0·95 produces fringes with a width of 1/60 of an order, there is little to be gained by using layers denser than that required to produce this reflectivity. The width of the fringes of the line 5436 is estimated by v. Klüber to be 1/34 order, equivalent to a reflectivity of 0·91. The measured width of fringes produced with silver layers was 1/39 order, for films with a transmissivity of 0·04. These fringes were thus narrower than those produced by the multilayer coating, but in both instances the fringe-width was probably substantially increased by imperfection in the surfacing of the plates.

Judged on the basis of existing experimental data, multilayer films offer the advantage of a very slight gain in intensity in the range of lower reflectivities, below about 0·9. This should make them useful as étalon coatings for special purposes; if they could be made to operate for violet and ultra-violet light, they might gain considerable importance in spectroscopic interferometry.

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[1] *Nature*, **169**, 790 (1952).

[2] Bright, R. J., Jackson, D. A., and Kuhn, H., *Proc. Phys. Soc.*, A, **62**, 225 (1949). Kuhn, H., and Wilson, B. A., *Proc. Phys. Soc.*, B, **63**, 745 (1950), and references given there.

The silver films reported by D. A. Jackson and K. Kuhn are very efficient; considerably more so than those quoted by previous workers[1].

In this connexion, I wish to state that I have recently produced silver films possessing a reflectivity of 94 per cent and an absorption coefficient as low as 0·03 for $\lambda = 5461$ A., so giving an efficiency similar to that recorded by Kuhn and Wilson[2] for an aged silver film at 5200 A. Extreme care was exercised with regard to the cleanliness of all the surfaces in the vacuum vessel.

From a graph in the same paper, for an aged silver film at 5200 A., one concludes that $R = 0{\cdot}97$ for $T = 0{\cdot}005$, that is, $A = 0{\cdot}025$. These values may be compared with those for the multilayer coatings which were the subject of a previous communication[3]:

Coating	R (per cent)	A (per cent)	T (per cent)	$\tau = \left(\frac{T}{T+A}\right)^2$
Silver (fresh)	97	2·0	1·0	0·11
Silver (aged)	97	2·5	0·5	0·03
9-Layer dielectric	97	2·0	1·0	0·11
Silver (fresh)	94	2·0	4·0	0·44
Silver (aged)	94	3·0	3·0	0·25
7-Layer dielectric	94	1·0	5·0	0·69

(The figures for silver are from Kuhn and Wilson's results for 5200 A., ref. 2.)

The multilayer coatings were measured during the two days following their production.

Since the underlying motive for pursuing the multilayer investigations was to obtain as large a transparency (τ in the table) as possible for the étalon compatible with a small fringe half-width—a feature of supreme importance for phenomena, such as solar flares, etc., of limited duration—the conclusion from the above is that the multilayer coatings possess the greater transparency for the lower reflectivity cited; but for the higher value the freshly prepared silver films of Kuhn and Wilson appear their equal. It must be stressed, however, that the multilayer characteristics were not obtained immediately after deposition.

The comments in the foregoing correspondence appertaining to the possibilities of multilayer coatings for the blue end of the spectrum would depend on suitable dielectrics being obtained exhibiting little absorption in this region; zinc sulphide, for example, has an absorption band[4] at 3650 A.

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[1] For example, Goos, F., *Z. Phys.*, **100**, 95 (1936). Tolansky, S., *Physica*, **12**, 650 (1946). Turner, A. F., Colloques Internationaux du C.N.R.S. sur Les Propriétés Optiques des Lames Minces Solides, Marseille, Avril 1949, p. 151.

[2] Kuhn, H., and Wilson, B.A., *Proc. Phys. Soc.*, B, **63**, 745 (1950).

[3] Jarrett, A. H., and von Klüber, H., *Nature*, **169**, 790 (1952).

[4] Abelès, F., *Revue d'Optique*, **28**, No. 1, 23 (1949).

Russell Effect on Evaporated Metal Films

In 1897, Russell[1] discovered that freshly abraded metal surfaces produce an image on photographic plates and suggested that hydrogen peroxide is responsible for this action. Although a considerable amount of work was done on this subject in the first decade of this century, the only more recent publication is a paper by Churchill[2]. Work in the Mechanical Engineering Research Laboratories at Thorntonhall confirms that hydrogen peroxide is produced whenever fresh surfaces of certain metals are exposed to the action of water and oxygen. When, for example, aluminium, magnesium, nickel or zinc is cut under water, measurable quantities of hydrogen peroxide are produced[3].

Recently, we have found that evaporated films of metals, when exposed to the action of oxygen and water vapour, are capable of producing an image on photographic plates. Before briefly describing the