

X-ray powder diffraction analysis showed that the foil contained gold and cobalt with evidence of more solid solution of cobalt in gold than would be predicted by the phase diagram as found by W. Klement, jun., in his investigations using the gun technique for rapid cooling<sup>6</sup>. In addition, however, the material we produced contained fibrous material which extended out from the main body of the foil and gave an X-ray pattern which contained broad diffraction halos with  $d$  values at approximately 4.5, 2.2 and 1.25 Å. It may be that these whiskers cooled much more rapidly than the main body of the foil and thus became amorphous. From these experiments, it appears that increased solubility can be obtained in the cobalt-gold system by rapidly cooling the melt and that with more rapid cooling the amorphous state can be produced in the alloys.

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<sup>1</sup> Metzger, W. H., *Symp. Electroless Nickel Plating, Amer. Soc. Test. Materials, Spec. Publ., No. 265*, 13 (1959).

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<sup>4</sup> Galasso, F., and Vaslet, R., *Rev. Sci. Instrum.*, **37**, 525 (1966).

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### Delineated Cadmium Films produced by the Photolysis of Cadmium Dimethyl

THE decomposition of some metal alkyls by ultra-violet light is well known and studies of free radicals produced by the photodecomposition of zinc, cadmium and lead alkyls have been extensively reported<sup>1</sup>. We have observed that when these compounds are admitted to a conventional vacuum system, metal films are deposited only where the ultra-violet light is incident on the walls of the system.

The pattern in Fig. 1a was produced by depositing cadmium metal on an image formed by ultra-violet light from a 200 W arc lamp. The lamp illuminated a metal mask 2 in. in diameter, a part of which is shown in Fig. 1b. A quartz lens 1.5 in. in diameter and of 7 in. focal length was arranged so that it focused a 0.5 in. diameter image of this mask on to a quartz substrate in the vacuum system. Initial focusing for the ultra-violet was accomplished by means of a fluorescent screen. The pattern in Fig. 1a was obtained by admitting 10 torr of cadmium dimethyl to the closed vacuum system and irradiating the substrate for 10 sec.

Fig. 1a shows that reasonably good delineation has been obtained although the thickness of the metal deposit was estimated by electron microscopy to be less than 100 Å. The very thin deposits in the dark regions of the ultra-violet image probably result from stray light reflected in the optical system. The metal deposit absorbed light from the 200 W lamp, causing a rapid increase in temperature; during longer irradiations, thermal decomposition produced a complete smearing out of the pattern. Later experiments with water cooled Chance optical filters have minimized this effect.

One would expect the deposit obtained from a gas phase reaction to be evenly distributed over the substrate and it would seem that the delineation of the cadmium film is caused by a heterogeneous photolytic reaction. Preliminary experiments with the quartz crystal microbalance, however, have shown that the rate of deposition of metal on the illuminated substrate is linearly proportional to both the pressure of cadmium dimethyl and the intensity of the illumination, showing that the reaction is primarily occurring in the gas phase. We suggest that the formation of an adherent metal film may require the impingement of unstable intermediates, for example, free metal atoms, from the gas phase. At the pressures used in these experiments, only the intermediates formed very

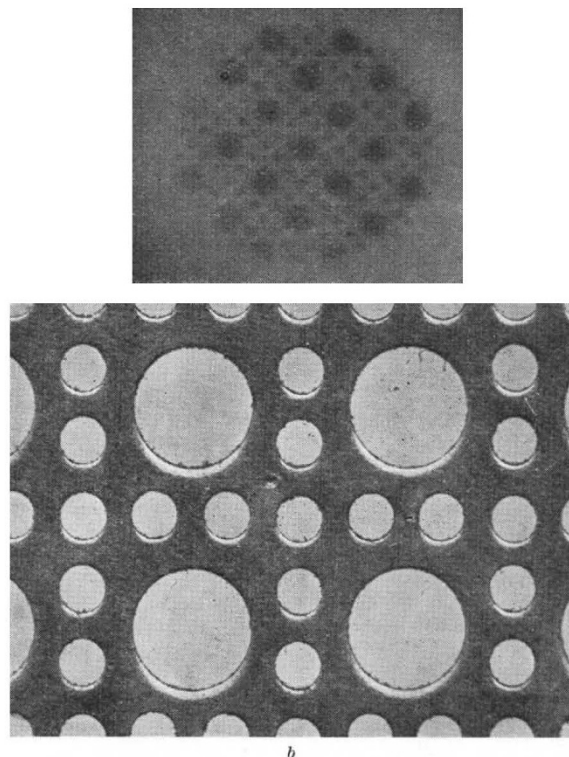


Fig. 1. The image (a) formed when cadmium was photodeposited from cadmium dimethyl and a part of the mask (b), shown on the same scale.

close to the surface are able to reach it before they are deactivated by molecular collisions.

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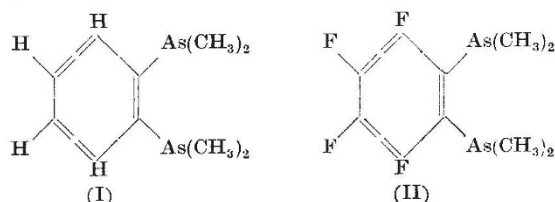
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## CHEMISTRY

### A Tetrafluoroditertiary Arsinic and its Metal Complexes

THE outstanding ability of *o*-phenylenebisdimethylarsine (diars) (I) to stabilize metals in unusual oxidation states (for example, Fe(IV)—ref. 1), co-ordination numbers (for example, tetrahedral Au(I)—ref. 2) and stereochemical arrangements (for example, dodecahedral Ti(IV)—ref. 3), has led us to investigate the preparation and co-ordinating properties of the tetrafluoro analogue (F-diars (II)).



It was expected that the fluorination of the aromatic ring would lead to enhanced electron withdrawal and would therefore assist back bonding from the metal to the arsenic but, at the same time, reduce the  $\sigma$  donor capacity of the arsenic atoms. Some remarkable effects resulting