Most bioassays in tobacco carcinogenesis studies have been carried out using either condensates, which are afterwards taken up in solvents at room temperatures, or tars derived from smoke trapped in organic solvents. It is now clear that such materials are deficient in unstable free radicals initially present in smoke. The free-radical content of cigarette smoke as a parameter in the etiology of lung cancer would therefore seem to be a reasonable possibility.

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Second Virial Coefficient of Methyl Chloride Vapour

THEORETICAL considerations, for example, those of Hirschfelder[1], indicate that the virial coefficients higher than the second cannot be large enough to produce, in the isotherms of vapours at reduced temperatures near 0·70, sufficient curvature to be detectable with the experimental techniques available at present. Nevertheless, there are several statements of curved isotherms in the literature. As pointed out previously[2,3], the greatest care is required if errors due to adsorption are to be avoided.

Hamann and Pearse[4] report measurements by a differential compressibility method on methyl chloride and methyl bromide and find that, at the low temperatures, there is an apparent non-linearity of PV with P which they attribute to either higher virial terms or to adsorption. In these experiments the vapour was compressed before an advancing mercury surface. By making reasonable estimates from the data of Bottomley and Reeves[3], it is clear that the non-linearity observed is of the order to be expected from neglect of the adsorption on the surfaces of the apparatus.

That adsorption errors are indeed responsible for this non-linearity is confirmed by experiments which we have carried out recently. The isotherms of methyl chloride have been determined at 22° C. in a differential compressibility apparatus similar to that used previously for xenon[5]. A strictly linear isotherm has been obtained over the pressure-range 750-150 mm. of mercury with eleven experimental PV values at both rising and falling pressures which show a mean deviation of ± 4 in 100,000 from the least-mean-square line. Adsorption has been rendered negligible by two factors. The surface/volume ratio is much lower in our experiments, and the bulbs containing the vapour were made of high-quality silica, which is much less adsorptive than other glasses.

In differential compressibility apparatus in which gas volumes are brought to the same pressure by a mercury manometer, there is a potential error. The mercury surfaces on the two sides of the null manometer are exposed to different gases : if one side contains a vapour near saturation the adsorption on the mercury surface may lower the interfacial tension, and hence the capillary depression, so that apparent equality in the two sides of the manometer does not correspond to equal pressures. This correction increases with increasing pressure of vapour, and is in the sense that equal mercury-levels correspond to the pressure of the vapour being greater than that of the non-adsorbed gas. Hamann and Pearse used a manometer tube of 5·7 mm. bore, giving a depression of about 1 mm., so that a mere 10 per cent change in depression amounts to a considerable uncertainty in pressure. Our null manometer is of 35-mm. bore (depression less than 0·001 mm.), and the associated difficulty of a large dead space is eliminated by a direct measurement of volume at each setting.

The final value for the virial coefficient for methyl chloride from our experiments is 416 ± 1 cm.^{3}/mole at 22° C.

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Promoting the Stable Eutectic Reaction in Magnesium-treated Iron Castings by Vibration during Solidification

BY adding magnesium to cast iron in such a way that a few hundredths of a per cent are retained in solution it is possible to suppress the stable eutectic reaction, and in iron so treated the metastable reaction occurs instead, resulting in castings which contain large amounts of iron carbide. Addition (after the magnesium has been dissolved) of about 0·5 per cent of ferro-silicon (containing 80 per cent silicon) favours occurrence of the stable eutectic reaction during subsequent solidification, and spheroidal-graphite particles are so produced[1]. The ferro-silicon alloy inoculates the stable eutectic.

It has now been discovered that the stable eutectic may also be inoculated by vibrating the mould during solidification of the casting. In this way magnesium-treated cast iron, which would normally solidify primarily by the metastable process, is caused to solidify by the stable process, with precipitation of spheroidal graphite.

Castings substantially free from iron carbide have been produced in this way from magnesium-treated metal containing less than 0·2 per cent silicon, cast into graphite moulds. In such a case the combined effects of magnesium, low silicon content, and high rate of solidification normally preclude graphitization dur-