

use of both the terms 'dynamic surface' and 'dynamic surface tension' be restricted to those surfaces to which solute is in the process of diffusing. When this process is complete, the surface can conveniently be said to have reached dynamic or diffusion equilibrium. All older surfaces would then be termed static, and would reach static equilibrium only after rearrangements in the surface film were complete. The broken line *XY* in the graph thus traces the variation of diffusion equilibrium with concentration, and represents the boundary between static and dynamic tensions. Methods of measuring surface tension are classified by common usage as static or dynamic, and it is of interest from the above results that static (as well as dynamic) methods are capable of yielding both static and dynamic tensions.

C. C. ADDISON.

Harris Institute Technical College,
Preston.
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¹ See Alexander, A. E., *Trans. Faraday Soc.*, **37**, 15 (1941), and references therein.

² Addison, C. C., *J. Chem. Soc.*, 252, *et seq.* (1944); *Phil. Mag.*, **36**, 73 (1945).

³ Addison, C. C., *J. Chem. Soc.*, 354 (1945).

3 : 4-Benzpyrene from Coal Tar

THE extraction of the carcinogenic hydrocarbon 3 : 4-benzpyrene from coal tar, whether by the original method of Cook, Hewett and Hieger¹ (using repeated fractional distillation, extraction with solvents, formation of picrates, and crystallizations) or by Winterstein's modification² (involving chromatography), is generally considered too laborious, and the yields obtained too low, to serve as a practical measure for routine supplies. Hence the use of synthetic 3 : 4-benzpyrene for most experimental needs. When it was found³, however, by a spectrographic method of estimation, that tar might contain as much as 1.5 per cent of benzpyrene, a re-investigation of the methods of isolating the hydrocarbon from tar seemed desirable.

Advantage was taken of the fact that sulphonation of benzpyrene does not readily occur with sulphuric acid alone in the cold, yet the hydrocarbon disappears completely from a solution on shaking with sulphuric acid. The expectation that the benzpyrene would be recoverable from the sulphuric acid washings (by dilution with water and re-extraction with an organic solvent) was confirmed; moreover, a quantitative test with pure benzpyrene yielded almost 100 per cent recovery. Its applicability as a means of isolating the hydrocarbon from tar seemed promising, since most other constituents of tar are either sulphonated by treatment with sulphuric acid in the cold, or else are left unextracted (the latter being the case, for example, with chrysene, and partly with pyrene).

Though the method was not practicable when applied directly to whole tar, owing to the very large amounts of sulphonated material obtained, it proved effective when tried on one of the crude distillation fractions of tar, obtained at 200–240° C. at a pressure of 0.1 mm. mercury (Hyvac and mercury pump), the fraction representing about 10 per cent of the original tar, and containing 2.4 per cent of benzpyrene (as estimated spectrographically).

10 gm. of this material in 100 ml. benzene was added to excess of petroleum ether, filtered, and the filtrate treated (at about 3° C.) with four successive

lots of concentrated sulphuric acid. The pooled acid extracts were diluted with water, and extracted twice with benzene. The benzene extract was washed with dilute alkali, dried with anhydrous sodium sulphate, mixed with twice its volume of petroleum ether, and passed through a column of alumina (B.D.H.). The column was then developed with a benzene-petroleum ether mixture (1 : 2), and the early (non-crystallizable) eluates were discarded; the later eluates were collected, evaporated and several times recrystallized (from methanol and from petroleum ether). This yielded 75 mgm of a pale yellow crystalline product, possessing the characteristic fluorescence spectrum of 3 : 4-benzpyrene, and the following m.p. values :

Crystalline product from tar	m.p. 171–173° C.
Synthetic sample for comparison	m.p. 175–176.5° C.
Mixed m.p.	171.5–173.5° C.

The yield of 75 mgm. of almost pure benzpyrene from 10 gm. of a crude distillate of tar, by a relatively simple procedure, seems sufficiently promising for application of the method on a large scale as a practical means for supplying this important hydrocarbon.

I. BERENBLUM.

Oxford University Research Centre
of the British Empire Cancer Campaign,
Sir William Dunn School of Pathology,
University of Oxford.

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¹ Cook, J. W., Hewett, C. L., and Hieger, I., *J. Chem. Soc.*, 395 (1933).

² Winterstein, A., *Festschrift Emil Barel*, Basel (1936), quoted by Cook, J. W., and Kennaway, E. L., *Amer. J. Cancer*, **33**, 50 (1938).

³ Berenblum, I., and Schoental, R., *Brit. J. Exp. Path.*, **24**, 232 (1943).

Aluminium Trimethyl

IN a recent letter, Burawoy¹ remarked that the ethane-like structure ascribed by us² to the dimeric form of aluminium trimethyl from electron diffraction investigations, and supported by Brockway and Davidson³, is most unlikely. He proposed an alternative.

This method of examination does not enable us to deduce structures for such complicated molecules. They must be invented and tried; and for such a case, especially when not many orders of diffraction can be observed, it is impossible to say that any one satisfactory solution is unique. We have therefore tried Burawoy's model, and a number of others which we devised on various hypotheses about the type of binding without regard to their probability, for it is clear that the binding, whatever it is, must be new in some degree. We entertained the possibility that the degree of polymerization is more than two⁴.

Burawoy's model proves unsatisfactory in both the qualitative and the quantitative fit of the simplified theoretical scattering curve with the observed scattering. We have, however, found three other more or less satisfactory models: I is a cage-type structure for the dimer; II is a ring structure for the trimer; III is a ring structure for the dimer with the ring not perpendicular to the plane of the other atoms. I is very good, II is quite good, III is fair. It may be recalled, also, that Brockway and Davidson rejected one of the ring models for the dimer (the sixth which they tried) more because it seemed improbable than because its scattering curve is bad. At present the experimental evidence available does not suffice for a definite choice between these possibilities to be made.