and a 6 atomic per cent molybdenum oxide-activated alumina catalyst in a mild steel catalyst tube, considerable formation of aromatics from pure 2.2.4. trimethyl pentane resulted, accompanied by cracking. The aromatics contained mixed xylenes, *o*-xylene being identified, together with some naphthalene.

The full results will be published elsewhere.

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[1] *Trans. Farad. Soc.*, **35**, 993 (1939).

Use of the Term 'Resolving Power' in Spectroscopy

THE classical description of the limit of applicability of an instrument by the resolving power $\lambda/d\lambda$ has been used in spectroscopy for many years in spite of very obvious drawbacks. Since the advent of the Bohr theory of spectra, the spectroscopist is not concerned with *wave-lengths* but with *frequencies* and *frequency differences*. If a concept of the power of instruments to resolve close lines is adopted in terms of frequencies, there results a considerable improvement in clarity and in practical applicability.

Consider as typical examples the use of a Fabry–Perot interferometer and of a grating to separate close components. The interferometer, air gap of thickness $t = 1$cm., is coated with aluminium mirrors having a uniform reflecting coefficient between 5,000 A. and 10,000 A. The grating has 100,000 lines to the inch and is to be used in the first order. Consider the use of the instruments for the resolution of close lines at 5,000 A. and 10,000 A.

With the interferometer the frequency difference which can be resolved at any wave-length is $d\nu = dn/2t$; that is, resolution depends only upon the fraction of an order dn which can just be separated with the gap used. This does not involve the wave-length if we have a uniform reflecting coefficient (the same is effectively true with the Lummer plate). The *shapes* of the fringes at 5,000 A. and 10,000 A. can be considered to be identical and as a result the *same* frequency difference can just be resolved at these two wave-lengths, or at any in between. The effectiveness or practical 'power' of the instrument is therefore *uniform* over the whole range. But if we evaluate $\lambda/d\lambda$, we find that the resolving power in the strict classical sense increases regularly with diminishing wave-length, being in fact twice as great at 5,000 A. as at 10,000 A. Clearly, as a description of the effectiveness of the instrument the resolving power is undesirable and should be modified.

With a strictly monochromatic source any instrument produces an apparent line width, owing to diffraction, etc., and it is, of course, this which sets the lower limit to the resolution. Instead of regarding this width as a wave-length difference, the frequency difference should be considered.

I propose that instead of using resolving power we define the ability of an instrument to resolve lines at any wave-length by $d\nu = \nu . d\lambda/\lambda$, that is, by the *instrumental line width in cm.*$^{-1}$ *at that wave-length.* This quantity, being equal to the wave number of a line divided by the classical value of resolving power, can readily be evaluated. A convenient name for this quantity would be the *resolving limit*, and it will be seen that it is a practical measure of the effective applicability of an instrument and in actual practice of more use than the classical resolving power. Thus in the interferometer, the line width is a certain fraction of an order (depending only upon the reflecting coefficient) divided by twice the gap. With a good instrument a fringe is 1/20 of an order wide; hence for the case under consideration the *resolving limit* is 0·025 cm.$^{-1}$ over the whole range 5,000–10,000 A. This is a practical index of the performance.

That the proposed new definition is superior to the classical resolving power is clearly demonstrated by considering the grating. The resolving power $\lambda/d\lambda = nm$ (in this case 100,000) is uniform over the whole wave-length range. On the other hand, the *resolving limit*, the *smallness* of which is the significant criterion, is proportional to ν, its value being $d\nu = \nu/nm$. It is thus half as much at 10,000 A. (namely, 0·1 cm.$^{-1}$) as at 5,000 A. (0·2 cm.$^{-1}$). It is therefore clear from this quantity that the farther one goes in the infra-red the better adapted is a grating for the resolution of close structures. This is a property not immediately obvious from the classical definition of resolving power, and rarely emphasized.

These two simple examples suffice to show that the classical resolving power as an index of an instrument should be replaced, for similar difficulties arise with any instrument employed over a wide wave-length range.

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"'Pancake' Ice in the Pennines"

SINCE my letter on the above subject was published in NATURE of May 3, I have received one or two communications commenting on the phenomenon, to which it may be of further interest to refer.

Mr. R. I. Lewis has kindly directed my attention to a note by his friend Mr. D. J. P. Phillips, of University College, Cardiff, which appeared in NATURE of February 5, 1914, under the title "A Curious Ice Formation". Having now had the opportunity of referring to the latter, I find that the short description given suggests quite clearly a parallel occurrence of 'pancake' ice formed under similar, though somewhat more artificial, conditions to those I described at High Force in Upper Teesdale. Mr. Phillips's illustrated example exhibited circular floes of ice encrusted with snow and having the appearance of water-lilies. They were found in the River Ure at Brecon where it had just passed over a weir, and they were apparently formed following the night of December 31, 1913, when 14° of frost had been registered locally.

From Mr. Henry Bury, of Bournemouth, I have received a short description of 'pancake' ice seen by him on January 23, 1933, on the River Loire at Gien (Loiret). He records that circular rafts of ice estimated at 4–6 ft. diameter, and covered with snow, were being carried along in a flooded and swiftly flowing river. The whirling motion imparted to these rafts, and the frequent collisions between them, were, in Mr. Bury's opinion, sufficient to account both for their form and for their conspicuous raised borders.

Consequently, it would seem amply clear that, under suitable and sufficiently 'rigorous' conditions, 'pancake' ice can be formed in other than the polar regions.

N. E. ODELL.