carbonyl group, leaving it highly susceptible to nucleophilic attack. With suitable substituents X and Y (obviously $X = Y = NHR$ cannot be generally useful), many uses for such mixed anhydrides present themselves. Reports on the systematic variation of X and Y, together with applications of the compounds produced, will be presented shortly.

N-Butylphenylacetamide. Phenylacetic acid (0·51 g) in dry benzene (6 ml.) was added to *tris*butylaminoborane (1·4 g) and the solution heated under reflux for 4 h. The reaction mixture was diluted with ether (5 ml.) and extracted with 3 N hydrochloric acid (2 × 5 ml.), water (5 ml.), saturated aqueous potassium carbonate (2 × 5 ml.) and water (2 × 5 ml.). The acid extract was brought to pH 9, saturated with sodium chloride and re-extracted with ether. The organic phases were combined, dried with magnesium sulphate, filtered and the solvent removed to yield 0·65 g (90 per cent) of a pure product with a melting point of 54°–55° C and which was identical in all ways with an authentic sample.

N-Butylisopropylidene imine. Diethyl ketone (0·518 g), *tris*butylaminoborane (1·5 g) and benzene (10 ml.) were heated under reflux for 8 h. The benzene was removed at water-pump vacuum, and the remaining solution brought over at 0·1 mm into a cooled (− 75° C) receiver. Fractionation gave 0·554 g (77·5 per cent) of a product with a boiling point of 86°/42 mm; its molecular weight was 141·1515 (and that required for $C_9H_{19}N$ is 141·1517).

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Effect of Hydrogen-containing Impurities on Ionization Times in Shock-heated Argon

THE mechanism by which impurities influence the time for shock-treated argon to reach equilibrium ionization has been considered on numerous occasions[1-4]. No results have as yet been published, however, describing the effect of specific impurities. To remedy this situation, I am now making measurements of the total ionization times (see Fig. 1) in primary shocks through argon to which controlled amounts of various gaseous impurities have been added. The degree of ionization is monitored by following the time dependence of the intensity of the continuum emission at 4900 Å. Preliminary results show that hydrogen, at concentrations greater than 100 p.p.m., produces a very pronounced decrease in the total ionization time, and this communication suggests a novel explanation for this effect.
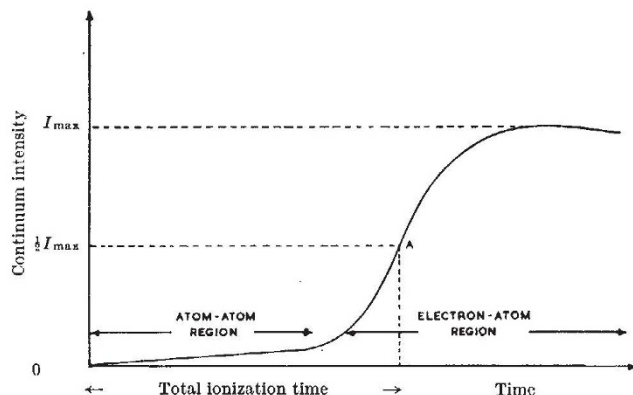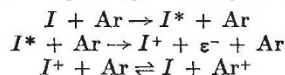

Fig. 1

Previously it has been assumed that the sole effect of an impurity I is to increase the rather slow ionization rate in the atom–atom region by a catalytic mechanism:

$$I + Ar \rightarrow I^* + Ar$$
$$I^* + Ar \rightarrow I^+ + \varepsilon^- + Ar$$
$$I^+ + Ar \rightleftharpoons I + Ar^+$$

While hydrogen can participate in such a scheme, it seems unlikely that the overall rate of ionization would be increased to an extent large enough to explain the observed results.

In the electron–atom region, the rate of ionization is limited by the rate at which energy can be transferred from the translationally hot argon atoms and ions to the electrons, which lose a considerable amount of energy in the ionization process:

$$Ar + \varepsilon^- \rightarrow Ar^* + \varepsilon^-$$
$$Ar^* + \varepsilon^- \rightarrow Ar^+ + 2\varepsilon^-$$
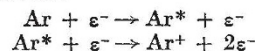
The dominant term in the rate of energy transfer at temperatures about 10,000° K is that between the electrons and argon ions, and can be written:

$$Q_{Ar^+} = \frac{N_{Ar^+} N_e e^4}{m_{Ar^+}} \left(\frac{8\pi m_e}{kT_e}\right)^{\frac{1}{2}} \left(\frac{T_{Ar^+}}{T_e} - 1\right) \ln \left[\frac{9(kT_e)^3}{8\pi N_e \, e^6}\right]$$

where m_e, N_e and T_e are the electron mass, number density and temperature respectively, and m_{Ar^+} and T_{Ar^+} can be taken equal to the corresponding atomic values. Because the hydrogen ion H^+ is about forty times lighter than the argon ion, this term will be increased in the presence of hydrogen to:

$$Q_L = \left(1 + \frac{N_{H^+} m_{Ar}}{N_{Ar} + m_{H^+}}\right) Q_{Ar^+}$$

At 10,000° K, the mechanism changes[1] from atom–atom to electron–atom at a degree of ionization, α, of about 5×10^{-4}. The presence of one part in 10^5 of H^+ will not only nearly double the rate of ionization at this point, but will extend the range over which the electron–atom mechanism is dominant to a lower value of α. It should also be pointed out that, while the commonest hydrogen-containing impurities in a shock tube are molecular hydrogen and water, molecules with many atoms of hydrogen, for example pump oil, may well play an important part, especially since their presence may not be detected.

At concentrations above 5 parts in 10^4, this effect can lead, in addition to a considerable reduction in the ionization time, to an increase in the ionization rate over the whole range of α for which the electron–atom mechanism is dominant, and this has been observed as an increase in the gradient of the light output with time in the electron–atom region, for example, at point A in Fig. 1.

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RADIOBIOLOGY

Effect of Total Dose, Dose Rate and Time of Irradiation on Synthesis of Deoxyribonucleic Acid

IT has been postulated that the process of DNA synthesis is radio-resistant. During the period of DNA synthesis of the cell cycle in regenerating rat liver, a large dose of radiation is required to produce any measurable effect[1-3]. This preliminary note reports three observations made from an *in vivo* investigation of the effect of X-irradiation