

LETTERS TO THE EDITOR

PHYSICS

Nuclear Nomenclature: Helion for Alpha-particle

I SUGGEST that the word helion be used for the α -particle, the nucleus of the helium atom.

The names electron, neutron, proton, deuteron, and triton are convenient, and are generally used. Helion for the helium-4 nucleus would be a convenient word to use in expressions such as bombardment with helions, helion-helion collisions, helion emitters, and the helion model of the nucleus.

The suggestion has been made several times that helion would be a better name for the lightest noble gas than helium, in that in the names of elements the ending 'um' occurs otherwise only for metals and metalloids. However, this suggestion has not found acceptance, and accordingly does not interfere with the acceptance of helium for the helium-4 nucleus.

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Units in Vacuum Measurements

WORRELL'S recent communication¹ on units in vacuum measurements directs attention to several anomalies tacitly accepted by many vacuum technologists. The use of molecular concentration as a measure of vacuum might be invaluable in some cases (for example, where a primary interest is in scattering of molecular or ionic beams, or in bimolecular particle reactions); nevertheless, the diversity of vacuum applications seems to have been overlooked. Apart from a few specialist studies, most vacuum technologists are more likely to be interested in vacuum *per se* than in pressure or molecular concentrations.

The use of a logarithmic scale for general vacuum technology, in which great accuracy is not required, has much to recommend it, but the scale should increase with increasing vacuum, and the actual values should be as small as possible (it is unlikely that many vacuum technologists would ever use numbers less than 10.0 on Worrell's scale, for this is equivalent to 2.83×10^{-13} torr).

I have for some years used the following scale:

$$pA = -\log_{10} (\text{pressure in atmospheres})$$

which has the advantages of increasing with increasing vacuum, being zero at atmospheric pressure, and being (usually) restricted to small numbers (Table 1). Moreover, it is related to that admirable, absolute gauge, the mercury manometer the readings of which, unlike those of ionization gauges or mass spectrometers, are independent of the gas they measure and invariant from day to day. As Table 1 shows, the various ranges of vacuum (medium, high, very high, etc.), defined by British and American Standards Committees, are well approximated on the pA scale by simple, integrally bounded ranges (for example, 3-6, 6-9, 9-12, etc.). The highest vacuum easily attainable using rubber gaskets in an unbaked system corresponds to a pA of about 10.

Pressure in torr	Atmos.	1	10^{-3}	10^{-5}	10^{-7}	10^{-12}
pA	0	2.9	5.9	8.9	11.9	14.9
Worrell's scale (ref. 1)	25.43	22.55	19.55	16.55	13.55	10.55
Vacuum	Low	Medium	High	Very high	Ultra-high	

It must be emphasized that logarithmic scales, however convenient and neat they may be in describing the state of a vacuum system, are of little use in calculations of

vacuum engineering, conductances, collision rates, etc. For a detailed understanding of the behaviour of molecules the customary, linear, scale is still invaluable.

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¹ Worrell, F. T., *Nature*, **199**, 476 (1963).

An Electrolytic Countercurrent Column for Isotope Separation: a Simplified Theoretical Approximation

IN this communication, the possibility is considered of multiplying a single electrolytic isotopic separation effect in a continuous process occurring in an electrolyser with a countercurrent flow and conversion of two immiscible liquid phases. The latter consisted of an electrode and an electrolyte. Such a process may—among other applications—be used to the enrichment of lithium. The process is presented schematically in Fig. 1. A solution of the

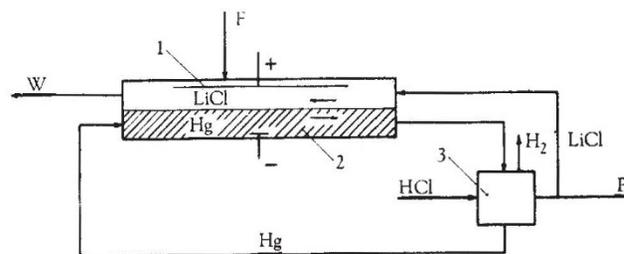


Fig. 1

lithium salt chosen is electrolysed during the flow between the immovable anode 1, and the movable cathode 2, which is mercury flowing in countercurrent. During the flow the isotopically enriched lithium is accumulated in the mercury. The resulting amalgam is then decomposed in the converter 3. The solution of the lithium salt obtained and the pure mercury are turned back to the electrolyser. Part of the solution of the salt in the converter can be taken off as the enriched product P . The dilute and isotopically exhausted electrolyte is removed from the device, which, owing to the apparent analogy, may be called the electrolytic column.

The considerations quoted here concern the extremely simplified conditions and aim at establishing both the theoretical possibilities of enrichment by this method and the direction of interactions of the principal parameters of the process.

It was assumed that the electrolyte is characterized by the following parameters: the flow rate, u_E , the diffusion coefficient, D_E , the concentration of the salt, c_E , and the concentration of the isotopic component of interest, y . The corresponding values for the liquid cathode are the following: u_C , D_C , c_C and x .

During the course of the work, the following assumptions have been made: (a) the concentration of the isotopic component of interest is small and therefore the separation factor $\alpha = x/y$; (b) the separation factor α , the molar conductivity μ and the diffusion coefficients D_E and D_C are independent of concentration; (c) there is no isotopic exchange between the phases; (d) no longitudinal mixing occurs; (e) the ratio of the linear rates of the electrolyte and the liquid cathode are proportional to the ratio of the diffusion coefficients $u_E/u_C = D_E/D_C$; (f) the diagonal