impurities, nitrogen and oxygen, are much above the energy available for the metastable state of argon (11.6 ev). However, by a well-chosen contaminant with an ionization potential below this value one can obtain a large increase in the ionization in argon. Thus, 0.2 percent of acetylene (ionization potential 11.2 ev) added to pure argon will produce an increase in ionization of 25 percent and a W of 21 ev/ion pair.

In view of the well-known difficulties of obtaining saturation for alpha-particle ionization measurements for air and probably oxygen, the corresponding values in the table may well be accepted with some degree of reserve. These difficulties have been emphasized by recent work,[4] where saturation was attained only at fields above 10 000 volts/cm. Alder, Huber, and Metzger,[5] also using fields of this order, employed a method of extrapolation to obtain a value of W for air at saturation of 34.7±0.5 ev/ion pair.

A ratio often calculated is that of W to the ionization potential of the gas in question. Such ratios, based on the W values for the five noble gases in column two of Table I, yield for the first four gases values which are almost constant at about 1.71. The ratio for xenon is only slightly higher. All semblance of constancy is lost if one uses in this way the older values of W found in the literature for helium and neon.

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The Neutron Activation of Ca^{46}

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(Received April 24, 1953)

THE natural abundance of Ca^{46} is low, and Ca^{47} has never been reported as observed in neutron-irradiated calcium. Sc^{47} has been observed as a product of $Ca(\alpha,p)$, (d,n), (p,γ),[1] $Ti(n,p)$,[2] $Ti(d,\alpha)$,[3] and Ca^{47} as a product of $Ca(d,p)$.[4] Ca^{47} has been observed directly in the calcium fraction from Cu spallation with 340-Mev protons, and the decay of Sc^{47} observed.[5] We have observed the decay of Ca^{47} in neutron-irradiated calcium indirectly, by observing the decrease in yield of Sc^{47} on successive milkings.

The irradiated calcium was spiked with Sc^{46} tracer, and the Sc fraction was removed, purified by T.T.A.-benzene extraction and ion exchange on Dowex-50, and estimated. This was repeated at weekly intervals for eight weeks.

The decrease in yield of Sc^{47} gave a half-life for Ca^{47} of 4.8±0.5 days, agreeing with the half-life quoted by Batzel, Miller, and Seaborg,[5] but not with the 5.8 days quoted by Matthews and Pool.[4] The thermal neutron activation cross section $Ca^{46}\rightarrow Ca^{47}$ was $0.25\pm0.1\times10^{-24}$ cm²/atom.

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Neutron Capture Cross Section of Em^{222}

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(Received April 24, 1953)

MEASUREMENTS have been made of the cross section of Em^{222}(Rn) for slow neutron capture in the NRX reactor, to form Em^{223} which has not been previously reported. This nuclide is expected to be a β-emitter with a calculated disintegration energy of 1.58 Mev,[1] and from this it may be estimated to have a half-life of about 5 minutes. Fr^{223}, the β-decay daughter of Em^{223}, is also short-lived but decays to Ra^{223}(AcX) which is an α-emitter with a half-life of 11.2 days. It seemed convenient to measure the production of Em^{223} by the growth of Ra^{223} during the neutron irradiation of the Em^{222}.

TABLE I. Data for cross-section calculation.

Expt.	$(Em^{222})_0$ mC	t hr	F n/cm²/sec	$(Ra^{223})_t$ dis/min	$\sigma(n,\gamma)Em^{222}$ barn
1	0.32_7	239	4.8×10^{13}	2460	0.7_6
2	0.27_2	264	4.7	1640	0.6_3
3	0.36_4	222	5.19	3035	0.7_8

The Em^{222} was extracted from an acid solution of $RaCl_2$, purified and sealed in a small quartz bulb for irradiation. A slow stream of helium gas was used to sweep the Em^{222} from the heated $RaCl_2$ solution. The gas was passed through two dry ice traps to remove water vapor and through an Ascarite absorber to remove hydrochloric acid gas. The Em^{222} was then adsorbed in a charcoal trap in a dry ice—acetone mixture. The charcoal trap was then heated and a small volume of helium gas used to sweep the Em^{222} into a small U-shaped quartz bulb immersed in liquid nitrogen to condense the Em^{222}. The bulb was finally evacuated and quickly sealed with a small flame just above the liquid nitrogen level. Some of the Em^{222} was lost in the evacuation, but sufficient was retained for the irradiation.

After about ten days irradiation in a high-flux position of the NRX reactor, the quartz bulb was crushed in a vacuum system and the residual Em^{222} removed. The Ra^{223} and the decay products of Em^{222} were taken up in nitric acid. The Po, Bi, and Pb decay products were separated from the Ra^{223} by two sulfide precipitations using 1 mg each of Bi and Pb carrier. About 25 μg of Ba was used as holdback carrier for the Ra^{223}. The solution was evaporated on a platinum disk for α-counting. The sulfide precipitates were dissolved in nitric acid, and an aliquot was evaporated on platinum for α-counting of the Po^{210} to determine the initial quantity of Em^{222} sealed in the quartz bulb.

The Ra^{223} was identified by α-pulse analysis which showed the three α-groups with energies of 5.72, 5.61, and 5.53 Mev characteristic of Ra^{223}. The α-activity decayed with a half-life of 11.1±0.2 days over a period of at least two half-lives.

The (n,γ) cross section of Em^{222} was calculated from the following equation:

$$\frac{(Ra^{223})_t}{(Em^{222})_0}=\frac{\sigma F\lambda_0}{(\lambda_0-\lambda_1)\lambda_1}(e^{-\lambda_1 t}-e^{-\lambda_0 t}),$$

where $(Em^{222})_0$ is the disintegration rate of the Em^{222} at the beginning of the irradiation, $(Ra^{223})_t$ that of Ra^{223} at the end, and λ_1 and λ_0 are the respective decay constants. F is the neutron flux during the time t of irradiation and was obtained from the calculated neutron distribution within the reactor and the reactor power log.

In three experiments an average value of 0.7_2 barn was found for the cross section σ of Em^{222}. The pertinent data are given in Table I.

The author is greatly indebted to B. G. Harvey for continued guidance and assistance throughout the course of this work.

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The β-Decay of Li^8

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(Received April 22, 1953)

THE β-decay of Li^8 is known to lead predominantly to the broad excited state of Be^8 at 3 Mev.[1] This provides an opportunity for studying the β-decay by observing the angular