fore observed under the same conditions as the Cu^{64} spectrum. Na^{22} is known[3] to emit very nearly one nuclear gamma-ray per positron. The height of the K-line caused by the 1.28-Mev gamma-ray was 0.24 times that caused by annihilation radiation, as seen in Fig. 1. After minor corrections, we conclude that Cu^{64} emits one 1.35-Mev

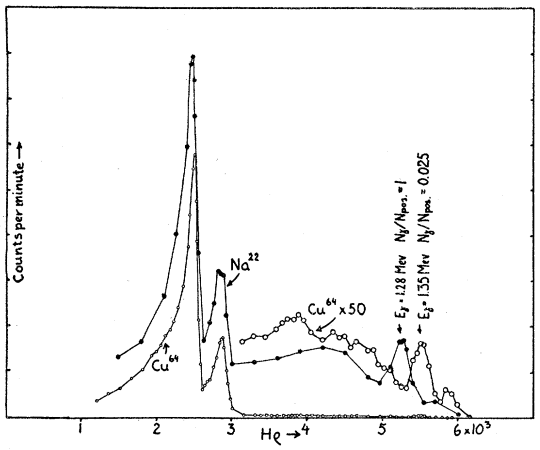

FIG. 1. Secondary-electron spectra produced by the gamma-rays of Cu^{64} (open circles) and of Na^{22} (solid circles). The thick radiatos causes the broadening of the photoelectron lines towards low energier but serves to emphasize the high energy gamma-rays.

nuclear gamma-ray from every 40 ± 5 positrons. This is about equal to the expected intensity of the hard component of the annihilation radiation. It may be seen in Fig. 1 that the secondary-electron distribution of Cu^{64}, instead of dropping for momenta below 4700-oersted-cm as one should expect from the Na^{22} spectrum, continues to rise to a maximum near 3800-oersted-cm and then falls off quite slowly. This is almost certainly caused by the hard annihilation radiation. The order of magnitude of the energy and abundance of the secondary electrons agrees with expectation, but the accuracy of the data is insufficient to allow quantitative comparison with theory. Further experiments in this connection are planned.

The very feeble nuclear gamma-radiation of Cu^{64} causes only insignificant corrections to the results of Good, *et al.* The hard annihilation radiation does not affect their results because the energies of the several positron spectra are all in the same range. In particular the result that an empirically second forbidden transition—Na^{22}—shows an "allowed" relative capture probability remains unchanged.

The author wishes to thank Dr. L. F. Curtiss of the Bureau of Standards for the uranium foil used as secondary-electron radiator. This work was supported in part by the Office of Naval Research.

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Mass Spectrographic Assignment of Activities to Re^{186} and Re^{188}

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August 25, 1947

A SAMPLE of ammonium-pyrrhenate solution was bombarded in the Argonne heavy-water pile to produce the 18- and 90-hour activities summarized by Seaborg.[1] In order to verify the assignment of the activities to certain isotopes, the activated material was analyzed by a mass spectrograph. This was done in the following manner:

A portion of the activated solution was placed in a tungsten crucible and evaporated to dryness. This crucible was then placed in the source system of the mass spectrograph, where it was heated and the emergent vapor ionized by electron bombardment. By operation of the spectrograph the ions were separated according to mass and deposited on a photographic plate.

Before development, two successive radio-autographs were made from this plate, the first for 36 hours and the second for 180 hours. The plate was then developed to provide mass markers.[2] Development of the transfer plates showed weak lines at masses 186 and 188 on the first plate. On the second plate only the line at 186 was observed, showing that the activity causing the exposure at 188 had a shorter half-life than that causing the exposure at 186.

A second portion of the original irradiated sample was followed by counting it concurrently with the production of the radio-autographs. This showed the presence of 18- and 90-hour half-lives. Therefore, the 18-hour half-life is assigned to mass 188, and the 90 hour assigned to mass 186, in agreement with Goodman's assignment.[3]

In order to determine which isotope of rhenium is responsible for the resonance absorption for neutrons of 2.3-volts energy, two additional samples of ammonium pyrrhenate were bombarded, one inside an aluminum cylinder with negligible neutron absorption and the other inside a cadmium cylinder of thickness such that the 0.18-volt cadmium resonant neutrons were reduced to less than 0.1 percent of the initial flux, while the flux of neutrons of 2.3-volt energy was reduced to 88 percent of the initial flux. By counting the resulting activity it was found that the ratio of initial activities of 18-hour half-life to 90-hour half-life was about 7 for the sample which had been bombarded in aluminum, and 2.5 for that in cadmium. As the half-lives have a ratio of five, the ratio of the number of 18-hour isotopes to the number of 90-hour isotopes is 1.4 to 1 for aluminum shielding and 0.5 to 1 for cadmium shielding. Since the production of the 18-hour activity is thus reduced by the cadmium, it appears that the 2.3-hour resonance absorption leads to the 90-hour activity at mass 186.

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