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Gamma Rays of Tellurium-131 and Tellurium-129

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The γ rays of Te^{131} and Te^{129} have been investigated by means of a crystal spectrometer.

EXPERIMENTAL

THE γ rays of Te^{131} and Te^{129} were studied in the laboratory for nuclear spectroscopy of this Institute by means of a crystal spectrometer equipped with a sliding channel. Energy and efficiency calibrations were performed by means of Hg^{203}, Cs^{137}, Na^{22}, and Y^{88}, and only photopeaks were used.

Most of the samples were prepared by irradiation of sodium tellurite with 26-Mev deuterons in the synchrocyclotron of this Institute. After iodine had been extracted twice, tellurium was precipitated in the presence of suitable hold-back carriers, and purified by a scavenging precipitation of ferric hydroxide and a second tellurium precipitation. In some cases Te^{129} was obtained free from Te^{131} via an antimony fraction separated by hydride formation from uranium oxide irradiated with deuterons. (These separations were performed in the Radiochemistry Laboratories.)

TELLURIUM-131

In the 25-minute period of Te^{131} the following γ energies were found: 145±10 kev (100), 450±10 kev (24), 595±15 kev (about 6), 950±15 kev (about 4) and 1140±20 kev (about 8). The figures given in parentheses indicate relative intensities, the last three are only rough approximations. Measurements of the total γ energy by means of a Geiger counter with known γ sensitivity indicate that about one γ ray of 145 kev occurs per β decay, and therefore the intensity ratios also give a rough value of the numbers of each γ ray per β process.

In the 30-hour period of Te^{131} the energies observed were: 145±10 kev, 770±20 kev, and 1140±20 kev. The intensity of the 770 kev is at least about as high as that of the 145 kev, and the 1140 kev is much stronger here relative to the 145-kev line than it is in the 25-minutes isomer. Because of the complex nature of the spectrum it was not possible to observe the 450-kev and the 595-kev γ rays here with certainty.

It should be mentioned that our results seem to be in agreement with the experiments of Geiger[1] if it is realized that the γ rays of higher energy cannot be recognized separately in absorption measurements.

It seems to be evident that the 145-kev transition goes to the ground state. It is tempting to assume that the 440-kev transition goes to the 145-kev level and that the 595-kev line represents the crossover of these two lines. From the difference in the intensity ratios in the 25-minute period and the 30-hours period, we may conclude that the 1140-kev γ ray and the 950-kev γ ray do not come from the same level. The main fraction of the 25-minute isomer seems to go to the 145-kev level.

In the decay of the 30-hour isomer the principal feature is the high intensity of the 770-kev γ ray, a line which we did not observe in the 25-minute period. Its occurrence is explained most easily by assuming a direct β decay of the metastable state of Te^{131} with a frequency comparable to that of the isomeric transition. Goldhaber and Hill[2] have given arguments for the possibility of such a direct β transition on the basis of the yield of the chemical separation of the two isomers. A very important fraction if not the main part of the direct β decay of the 30-hour isomer is followed by the 770 kev γ ray, a smaller fraction by the 1140-kev γ ray.

TELLURIUM-129

By far the larger part of the β decay of the 72-minute period of Te^{129} goes to the ground state, unless there should be a low-lying level in I^{129} with an energy below about 70 kev. A γ line of 435±20 kev occurs in about 9 percent of the β transitions, and a γ line of 1080±40 kev in about 0.7 percent.

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[1] K. Geiger, Z. Naturforsch. **7a**, 579 (1952).

[2] M. Goldhaber and R. D. Hill, Revs. Modern Phys. **24**, 179 (1952).