On the Decay of the $^{95}$Tc Isomer (*)

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Summary. — The $\gamma$-ray spectrum following the radioactive decay of the $^{95}$Tc isomer (half life 62$^d$) has been investigated by scintillation techniques. The sources were obtained by Mo(d, 2n) reactions in the synchrocyclotron of the Institute for Nuclear Physics Research in Amsterdam. The measurements were performed with a NaI(Tl) well-type crystal (76 mm $\times$ 76 mm) and the different spectra were displayed in a 200 channel LABEN analyser. $\gamma$-$\gamma$ cascades were investigated with a conventional coincidence set-up and using the summing technique. The direct disintegration of the isomeric state of $^{95}$Tc to the stable $^{95}$Mo, in competition with the 39 keV isomeric transition to the $^{95}$Tc ground-state, is confirmed. Excited levels of 1040, 820, 780 and 203 keV are assigned to the $^{95}$Mo structure, de-exciting mostly with the following transitions, in keV: 1040 (5$\pm$1), 838 (38$\pm$4), 820 (13$\pm$2), 780 (17$\pm$2), 580 (50$\pm$5); 203 (100).

1. — Introduction.

$^{95}$Tc is known to disintegrate into $^{95}$Mo by positrons and electron captures with two different activities corresponding to the 20 h ground state decay and to the 60 days metastable state decay. The two activities have been reported by several authors (1) who used $(x, p)$, $(p, n)$ and $(d, 2n)$ reactions to produce them.

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The first type of decay seems to occur only by electron capture (2) populating levels in $^{95}$Mo at 1070, 930 and 760 keV which de-excite by direct $\gamma$-rays to the $^{95}$Mo ground-state (2,3).

The second type of decay occurs also by two weak positon transitions of 460 and 680 keV (4) and seems to populate levels at 1020, 770 and 200 keV in $^{95}$Mo as deduced by the associated $\gamma$-rays of energy: 1020, 810, 570 and 201 keV (2,3,5).

The metastable state decays also to the $^{95}$Tc ground state by a 39 keV isomeric transition, for 3% of the total number of disintegrations, as established by MEDICUS and PREISWERK (4).

Some ambiguities about the level structure of $^{95}$Mo have been solved more recently by UNIK and RASMUSSEN (7) who studied the decay of the $^{95}$Tc isomer essentially with high resolution spectrometer techniques.

They found $\gamma$ transitions of energy 204, 584, 763, 768, 784, 822, 837 and 1040 keV and assigned levels at 204, 763, 784, 788, 822 and 1040 keV to $^{95}$Mo, populated from the decay of the $^{95}$Tc metastable state, while the 768 keV $\gamma$-ray was interpreted as the de-excitation of the level at the same energy known from the decay of the $^{95}$Tc ground state. However the relative photon intensities were mostly deduced from the relative internal conversion electron intensities and on the basis of theoretical interpretations of the $\gamma$ transition multipolarities. The level structure of $^{95}$Mo, as proposed by UNIK and RASMUSSEN, is mostly based on these deductions.

In order to obtain independent direct information about the de-excitation properties of the $^{95}$Mo levels populated from the decay of the $^{95}$Tc isomer, the $\gamma$-ray spectrum associated with this decay was investigated in a detailed way at this laboratory, using scintillation techniques.

2. - Source production and experimental techniques.

Several sources of $^{95}$Tc were produced by bombarding natural Mo with 24 MeV deuterons (20 $\mu$Ah) in the synchrocyclotron of the Instituut voor Kernphysisch Onderzoek (IKO) in Amsterdam. The irradiated targets were