SEARCHING FOR PHOTONUCLEAR REACTION ON NATURAL Ti WITH 65 MEV BREMSSTRAHLUNG

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Abstract. Photonuclear reactions formed via the irradiation of bremsstrahlung beam with end-point energy of 65 MeV from LINAC (Pohang, Korea) are presented.

1. Experiment

With high energy beam from accelerator, many reactions appear; this is a very good chance for produce radioactive isotopes. In this paper, some photonuclear reactions formed via the irradiation of bremsstrahlung beam from LINAC (Pohang-Korea) are presented.

1.1. Irradiation

The 65 MeV bremsstrahlung were produced by bombarding electron beam (accelerated up to 65 MeV) into Tungsten target (W). This bremsstrahlung beam was used to irradiate a TiO_2 powder . The TiO_2 powder sample was contained in a cylinder with h=5mm, d = 10 mm. A schematic diagram of the experimental set-up is showed in Fig.1.

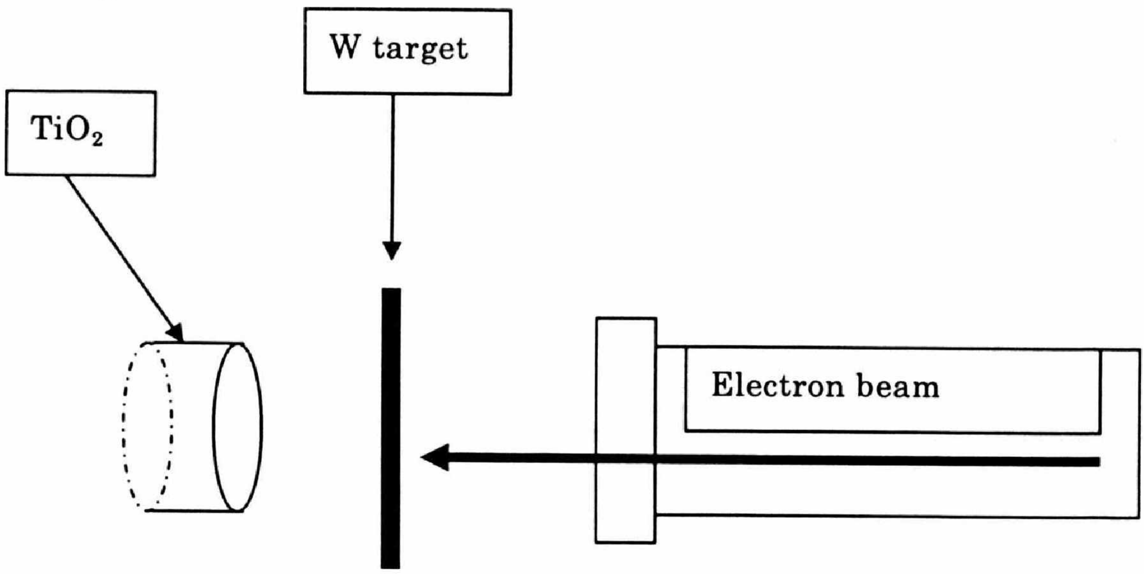

Fig.1. A schematic diagram of the experiment at LINAC, Pohang

The TiO_2 powder was irradiated for 2.0 h with 65 MeV bremsstrahlung beam and pulse electron beam was 40 mA. The sample was fixed at one position.

1.2 Measurement

- The decay time of irradiated sample was from 2 to 60 hours
- Measuring time varied from 60 seconds up to 10 hours
- Gamma spectra were analysed by using gamma vision program

The irradiated sample was mearsured for 30 times, the following photopeaks in keV were found in the photonuclear reactions for TiO_2 (Table 1)

Table 1. The photopeaks in photonuclear reactions for TiO_2

Number, ROI-RANGE(keV)	GROSS, counts	NET, counts	Error, ±	CENTROID, keV
1 46.40 62.92	1853597	352091	2758	54.54
2 70.70 79.44	836728	7125	1343	74.28
3 95.48 104.23	1161559	44717	1569	99.61
4 137.27 146.02	1477632	29363	1779	141.73
5 149.91 164.00	15936873	13850248	4711	159.63
6 166.91 180.03	1347746	232305	2079	175.53
7 216.96 225.71	686634	3128	1218	221.27
8 267.01 275.75	697042	67160	1196	271.63
9 314.62 323.37	718894	2952	1246	318.70
10 369.04 377.78	432011	86794	913	373.21
11 392.84 401.59	270861	8430	759	397.36
12 473.48 482.23	208231	8569	664	478.07
13 491.45 496.80	160825	1027	401	494.88
14 507.00 515.74	7242364	6018612	2944	511.51
15 560.43 569.17	107409	4489	476	564.57
16 589.57 598.31	108647	5395	478	593.85
17 613.37 622.11	141882	36673	514	618.00
18 716.33 725.07	113340	4749	489	720.71
19 885.32 894.06	159307	70925	512	889.69
20 904.74 913.48	88875	3837	433	909.45
21 930.47 939.21	103112	19743	447	934.85
22 979.51 988.25	496129	416443	767	984.03
23 1017.86 1026.60	54845	1316	342	1021.97
24 1033.89 1042.62	454850	390940	727	1038.08
25 1080.00 1088.74	41880	-202	301	1084.55
26 1117.87 1124.66	83062	53787	312	1121.08

27 1127.09 1133.40	28262	6196	188	1129.73
28 1152.82 1161.56	539954	486770	775	1157.46
29 1209.12 1217.86	20262	8846	183	1213.27
30 1293.09 1299.89	10202	517	122	1297.20
31 1301.83 1319.78	370635	349260	680	1312.37
32 1364.43 1373.17	4912	425	100	1369.11
33 1404.23 1412.96	5664	1471	102	1409.03
34 1456.64 1465.37	4685	1056	94	1460.99
35 1467.80 1474.59	2869	189	64	1471.00
36 1483.32 1492.06	3535	321	85	1487.70
37 1494.97 1503.70	6675	3502	101	1499.64
38 1520.20 1528.93	11990	9054	124	1524.79
39 1657.02 1671.09	8504	3684	151	1667.61
40 1726.40 1734.16	1216	40	46	1730.97
41 1739.01 1748.71	1484	42	60	1746.28
42 1761.81 1767.14	916	96	30	1763.98
43 1803.52 1813.23	1835	375	63	1807.69
44 1842.81 1850.58	1076	87	43	1846.88
45 1956.31 1964.07	1535	178	51	1960.68

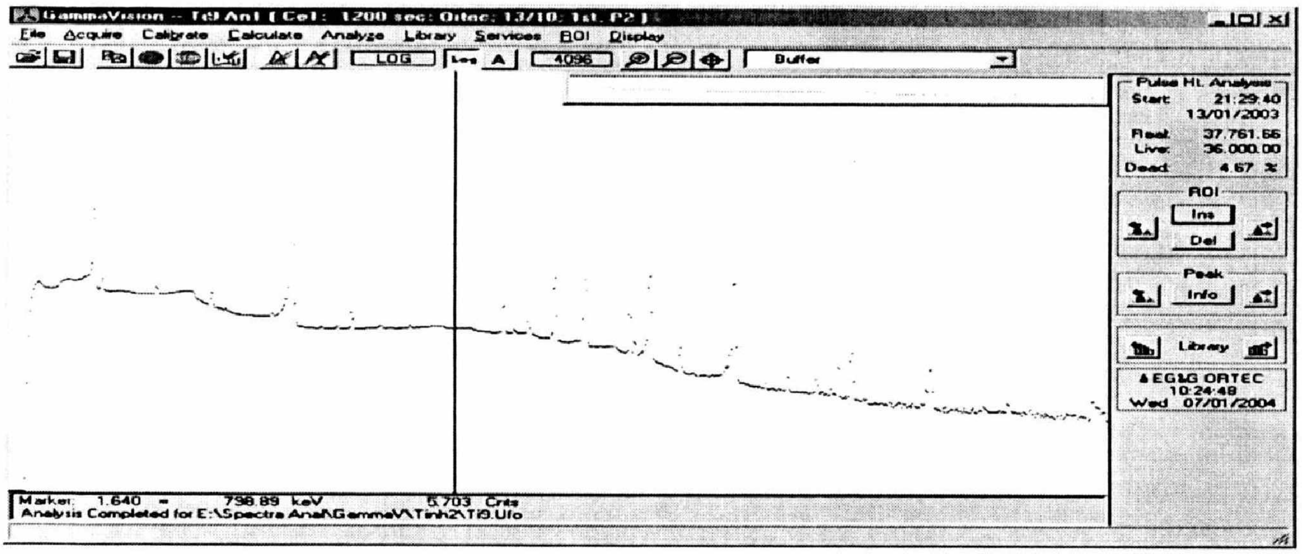

Fig. 2. Gamma spectrum of ^{44}Sc measured by Gammavision Spectrometer

2. Results and discussion

After analysing all the mearsured spectra and comparing the analysised data with the data of radio isotopes, the following reactions were found:

Ti(γ,n) {for Ti^{46}}

Ti(γ,2n) { for Ti^{47}}

Ti(γ,p) { for Ti^{47}, Ti^{48}, Ti^{49}, Ti^{50}}-> Sc

Ti(γ,2p) { for Ti^{49}} -> Ca^{47}

Ti(γ,pn) { for Ti^{46}, Ti^{48}, Ti^{49}, Ti^{50}} -> Sc

Ti(γ,αp) { for Ti^{47}, Ti^{48}, Ti^{49}, Ti^{50}} -> K

The data is suitable with the reference data.

This result can be used for:

Nuclear data (Cross-section)

Nuclear structure

Nuclear analysis

Radioisotope production

References

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