

A Study on a Measurement of Thermal Neutron by Optical Fiber Scintillator

150

가 5cm 0.5mm 1mm ⁶Li

Abstract

Thermal neutron detection using optical fiber scintillator(enriched in ⁶Li) was described. The shapes of the fiber are 0.5mm and 1mm diameters by 5cm length, respectively. For remote measurement, the fiber scintillating assembly was connected with an optic cable for the fluorescence light transmission between the fiber and PMT. This detection was used to pulse-height spectrum due to interaction with radioactive material. The result showed the neutron could be detected in spectrum. Also, the fiber was carried out reliability for high radiation dose at spent fuel.

1.

가 가

(Optical Fiber Scintillating : OFS)가

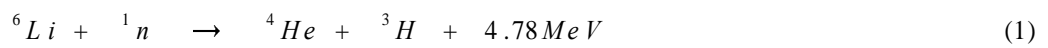
OFS Lithium(Li) 2% 11%
(⁶Li= 8%) Li

가 ⁶Li 95% [1].

0.1mm 2m 가 ,
 2mm cm 가 .
 가 , bundle bundle
 layer 가 가 가
 가 가
 가 -130
 (specific gravity) 2.5
 +120 가
 (4) 가
 NaI(Tl) 4 6%
 1 2%
 Li
 1MeV ,
 (deuteron)
 2.1, 2.8 9.5 1
 (triton)가 (MeV) 20 30%
 1.2MeV [2, 3].
 가
 (electric pulse amplitude)
 (pulse-height spectrum)

2.

Cerium (Ce) (activator) ,
 (inorganic scintillator) NaI(Tl)
⁶Li ⁶Li
 Li
 (1)



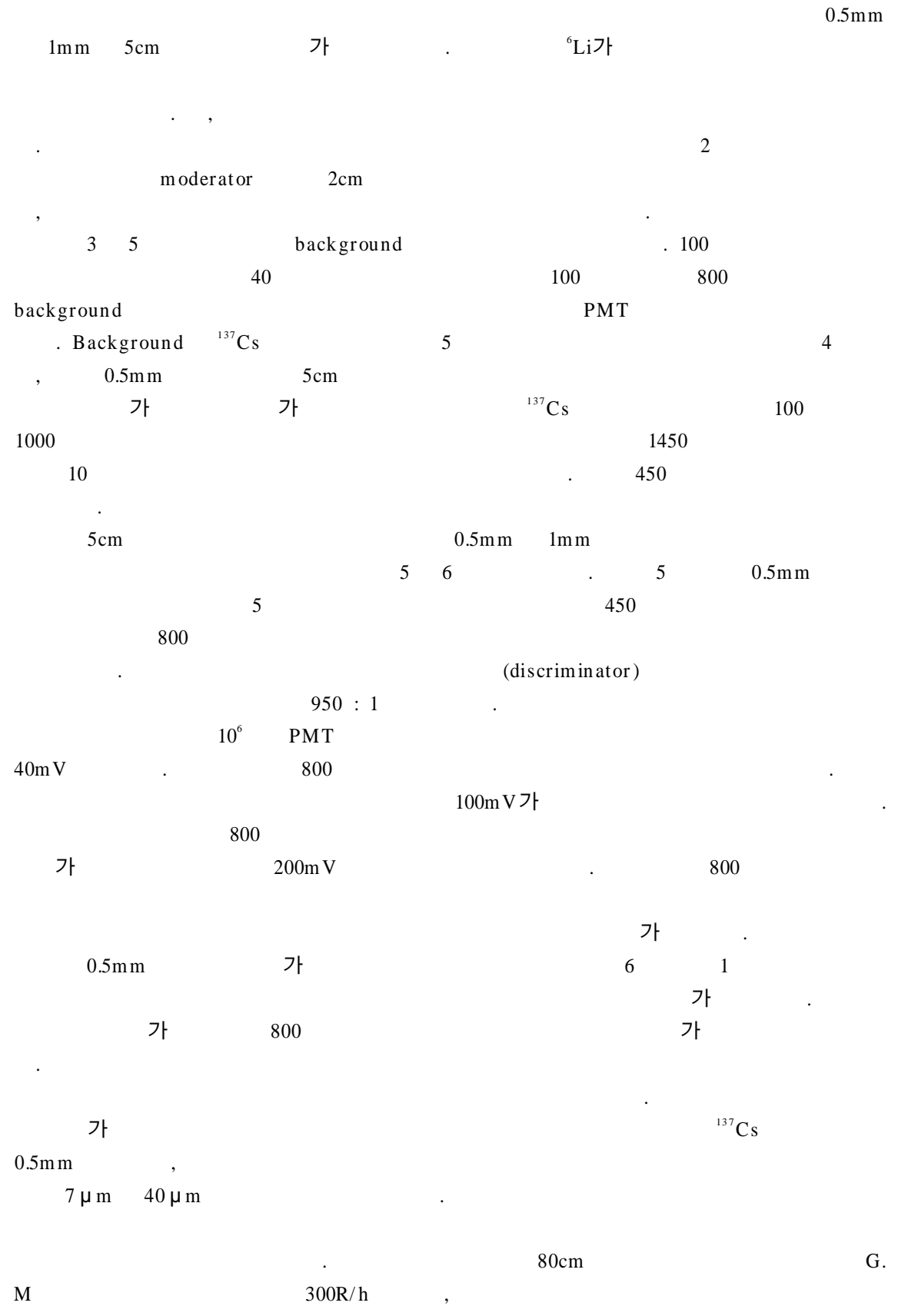
4.78MeV 가 ⁴He
 2.05MeV 가 ³He 2.73MeV .
 (range) 7 μm 40 μm

[4].
 가 ${}^3\text{He}$ ${}^{10}\text{B}$
 1/10 [2]. ${}^6\text{Li}$
 (0.025eV) 940 barns 가 10keV 1/V (V: 가
) . 120mm 가 가
 (4) 가 [5].
 Ce^{3+} (excitation state) (ground state)
 (de-excitation)가 가 가
 ${}^6\text{Li}$ 375 450nm [6].
 (photo multiplier
 thbe : PMT) (amplitude)
 가 .
 PMT (dark current)

3.

PMT
 PMT
 Ce^{3+} 330 480nm 가
 395nm 가
 가 [7].
 1 , PMT
 , PMT
)가 . 가
 ${}^6\text{Li}$ 가 95%
 Ce 0.5mm 1mm .
 0.04mm 가
 400nm km 70dB
 m 95% . PMT
 10^6 nA .
 ${}^{241}\text{Am}/\text{Be}$ (30mCi) ${}^{137}\text{Cs}$ (100 μCi)
 , moderator 4cm polymer [8]
 X- 0.15mm polymer

4.



, 4000 (167)

7

(saturation)

5.

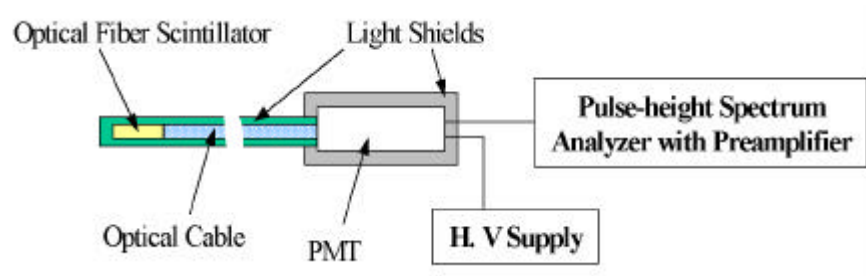
가 5cm	0.5mm	1mm
	0.5mm	800
가	1mm	

가

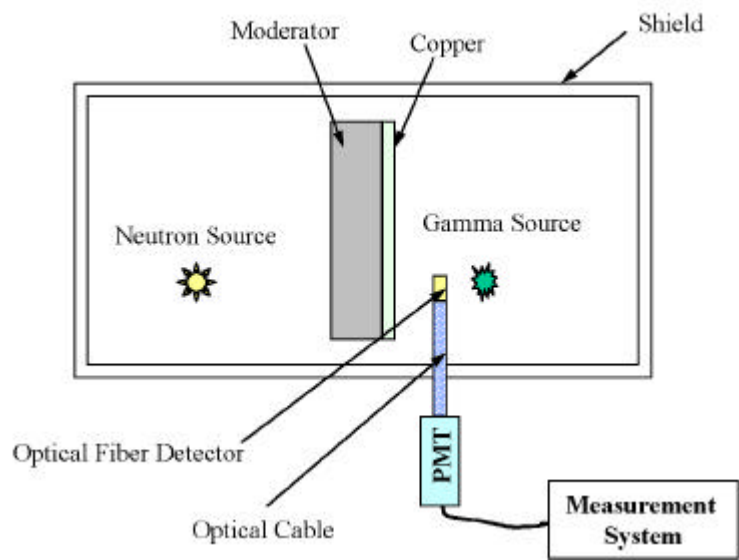
가

가

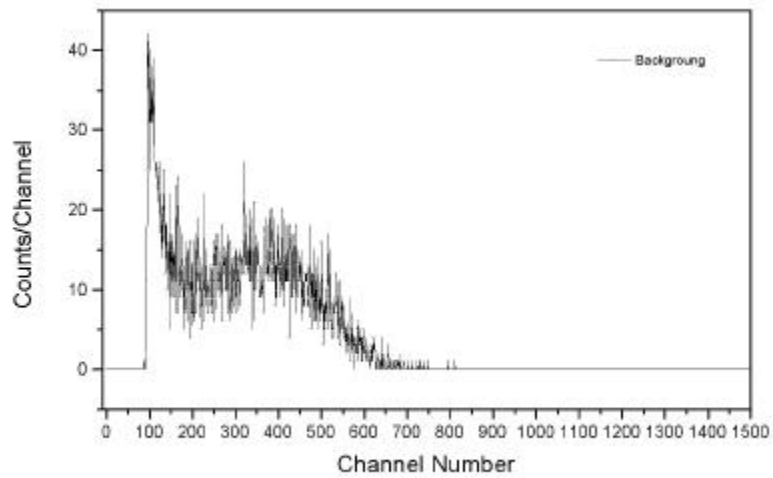
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- [2] G. F. Knoll, "Radiation Detection and Measurement, 2nd Edition," John Wiley & Sons, Inc., 1989.
- [3] N. Toulfanidis, "Measurement and Detection of Radiation," McGraw-Hill Co., 1983.
- [4] K. H. Abel, et al., "Scintillating-Glass-Fiber Neutron Sensors." Symposium Radiation Measurement and Applications, May 16- 19, 1995.
- [5] M. Bliss, R. A. Craig, "A Variety of Neutron Sensors Based on Scintillating Glass Waveguides," Fiber Optic Sensor Workshop, May, 1995.
- [6] K. H. Abel et al., "Scintillating Glass Fiber-Optic Neutron Sensors," Symposium Radiation Measurement and Applications, April 16- 19, 1994.
- [7] Diaguide Optical Fiber Catalogue : Fiberscope, Mitsubishi Cable Industries, Ltd.
- [8] M. Briss et al., "Scintillating Glass Fiber Neutron Sensors : I. Production and Optical Characterization," Workshop on Scintillating Fiber Detection, Oct. 24- 28, 1993.



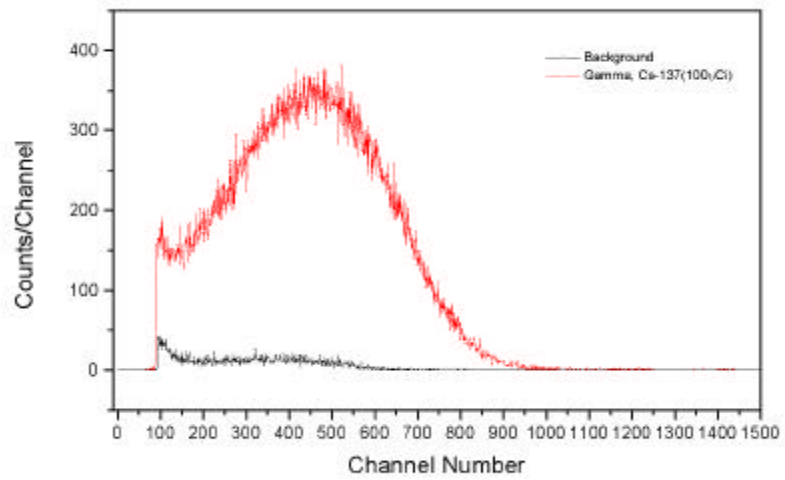
1. ${}^6\text{Li}$



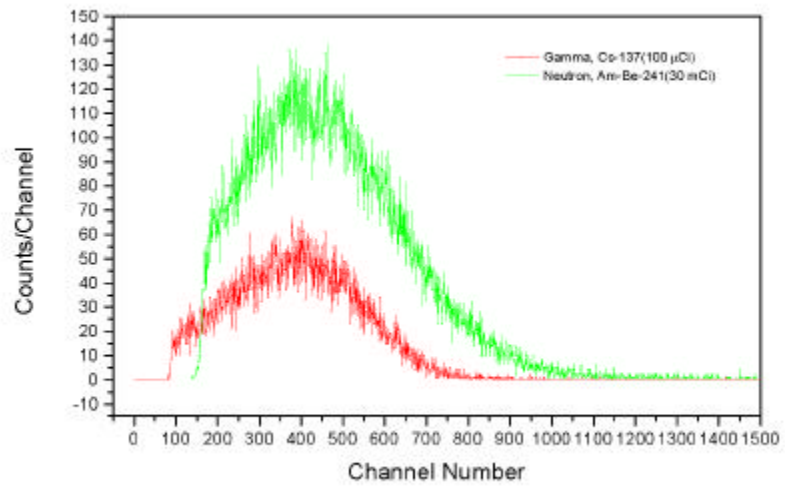
2.



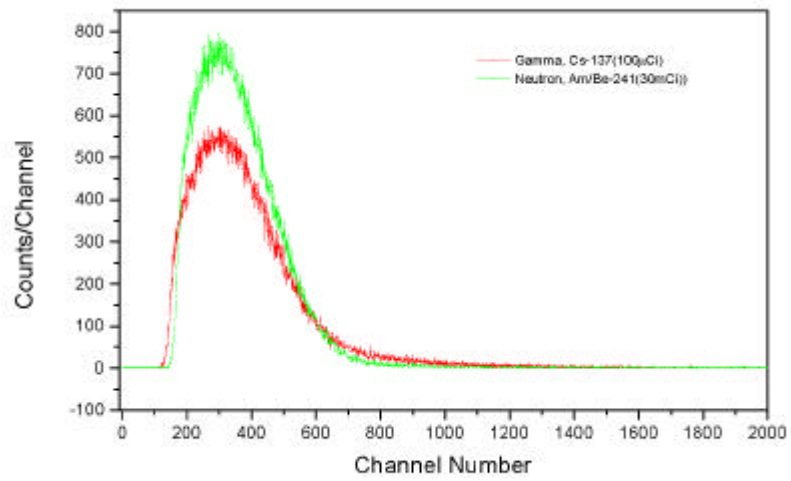
3. Background



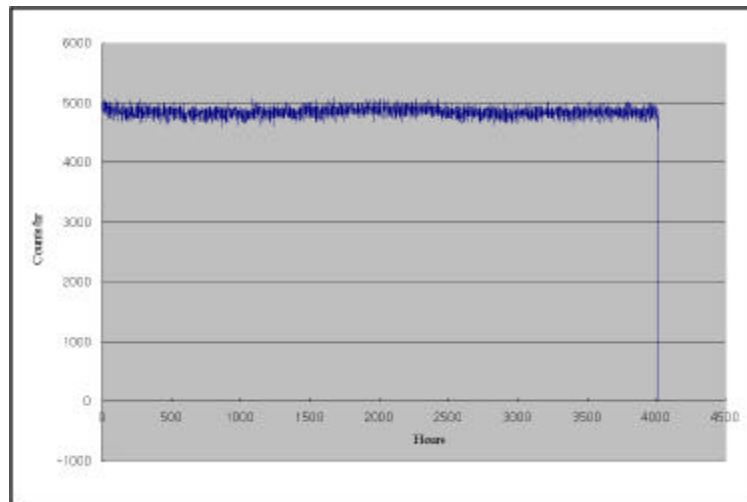
4. 0.5mm, 5cm
Background ^{137}Cs



5. 0.5mm, 5cm
(^{137}Cs) ($^{241}\text{Am}/\text{Be}$)



6. 1mm, 5cm
 (^{137}Cs) $(^{241}\text{Am/Be})$



7.

