Interaction of High-Energy Proton Beam with a Thin Target and Multiplicities of Neutron

İ. DEMİRKOL[*], A. ARASOĞLU[**], E. TEL[***], M. TATAR[*] AND M.S. ŞAFAK[*]

[*]*Kahramanmaras Sutcuimam University, Faculty of Art and Science, Department of Physics, K.MARAŞ-TURKEY*
[**]*Yüzüncü Yıl University, Faculty of Art and Science, Department of Physics,VAN-TURKEY*
[***]*Gazi University, Faculty of Arts and Science, Department of Physics, Beşevler, ANKARA-TURKEY*
Corresponding author: e-mail:idemirkol@ksu.edu.tr

Abstract. An important ingredient in the performance of accelerator driven systems for energy production, waste transmutation and other applications are the number of spallation neutrons produced per incident proton. The neutron multiplicities, angular and energy distributions are usually calculated using simulation codes. We have presented multiplicities of the neutrons emitted in the interaction of a high-energy proton (1500 MeV) with a thin target Pb, Bi. In this study we have used the code ISABEL to calculate multiplicities of the neutron emitted. The results obtained have been compared with the available data.

Keywords: Nuclear reaction models and methods, Spallation reactions, Projectile and target fragmentation
PACS: 24.10.-i; 25.40.Sc; 25.70.Mn

INTRODUCTION

Since some years, spallation reactions have gained considerable interest due to their importance in technical applications. They can, for example, be used for production of neutrons in spallation neutron source, and they can act as an intense neutron source in accelerator-driven sub-critical reactors, capable of incinerating nuclear waste and of producing energy [1,2]. Recently, some experiments on p +^{nat}Pb were done, but theoretical analyses have been deficient. This work analyses theoretically the dependence of the number of spallation neutrons produced per incident proton on projectile proton energy.

RESULT AND DISCUSSION

Spallation reactions have recently captured an increasing interest due to technical applications as intense neutron sources for accelerator-driven subcritical reactors or spallation neutron sources[3]. The mean spallation residue and fission-fragment kinetic energies are particularly important in the technical design of the accelerator driven sub-critical reactors due to their ability to induce severe radiation damages in the structural materials. In this study the calculations were made with the ISABEL code. Level density is taken from Gilbert and Cameron. The neutron multiplicity per proton and average energy of neutrons ejected after evaporation has been calculated. Angle dependent neutron spectrum of reaction p+Pb for energy 1500 MeV has been examined. The results were compared with other theoretical studies, and examined the relation between to each other.

TABLE 1. Comparison of neutron multiplicity per proton and average energy of neutrons ejected after evaporation

	ISABEL	ISABEL	JAERI [4]
	1500 MeV		1220 MeV
	Bi	Pb	Pb
Neutron multiplicity per proton	7.05	7.19	13.89
Average energy	2.75	2.71	

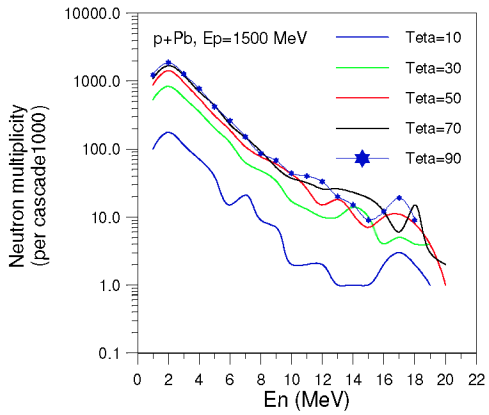

FIGURE 1. Multiplicity neutron as dependent angle with collision p+Pb for energy 1500 MeV

This study has been supported by TUBİTAK with career program number of 104M212.

REFERENCES

1. C.D. Bowman, et al., Nucl. Instrum. Methods A 320 (1992) 336
2. İ. Demirkol, et al., Nuclear Science and Engineering, 147 (2004) 83-91
3. J.M. Carpenter, Nucl. Instrum. Methods 145 (1977) 91
4. D. Hilscher, et al., Nucl. Inst. Meth. A414, 100 (1998)

CP899, *Sixth International Conference of the Balkan Physical Union,* edited by S. A. Cetin and I. Hikmet
© 2007 American Institute of Physics 978-0-7354-0404-5/07/$23.00

Downloaded 30 Apr 2007 to 193.255.96.253. Redistribution subject to AIP license or copyright, see http://proceedings.aip.org/proceedings/cpcr.jsp