OSAKA UNIVERSITY INTENSE 14 MEV NEUTRON SOURCE (OKTAVIAN) AND ITS UTILIZATIONS FOR FUSION STUDIES

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A 14 MeV neutron generator OKTAVIAN for fusion studies was constructed at Osaka University[1]. The performance data of the accelerator are presented in Table-1. Two beam-transport lines of OKTAVIAN, as shown in Fig.1, are made for special purposes, i.e. the sharply pulsed source of 14 MeV neutrons in pulse line and the continuous source of high intense neutrons in DC line.

In the pulse line, relatively broad pulsed D^+ beam of 30 to 50 nsec width is first produced by main and auxiliary deflectors installed after the switching magnet. Then by the 4 MHz Klystron Buncher this pulsed beam is bunched to generate 14 MeV neutrons with 1.5 nsec width in FWHM. (Peak D^+ current is 16 mA at the 10 Ci TiT target.) The pulsed neutron yield is about 10^4 n/pulse. Several experimental programs[2)~4)] of fusion neutronics are in progress by using this pulse line.

In the DC line, rotating target (20 cm dia. 800 Ci TiT) is used with 400 to 800 r.p.m. to remove heat-deposit (6 KW at maximum) by D^+ beam of high power density (1 KW/cm^2). The D-T neutron yield of more than 3 x 10^{12} n/sec can be expected by the preliminary experiment, in which we observed D-D neutrons of 2.5 x 10^{10} n/sec for 20 mA D^+ beam on the self-loading target. This DC line will be utilized for the studies on fundamental process of radiation damage in fusion materials, neutron-induced activities and radiation shielding, etc.

Table-1 : "OKTAVIAN" parameters

Ion Source	Duoplasmatron (modified DP 240 in High Voltage Co. Ltd.)
DC High Voltage Supply	33 KHz High Frequency Cockcroft-Walton type, 300 KV, 80 mA (max.)
Beam Analysing Magnet	45° at the outlet of ion source
Accelerator Tube	12 stages, 1200 mm length
Beam Switching Magnet	37.5° for DC line -30° for pulse line
"DC line"	
Target Current at R.T.	20 mA (D^+)
Beam Spot Size	less than 30 mmϕ
D-T Neutron Yield	3 x 10^{12} n/sec (expected)
"Pulse line"	
Repetition Frequency	1 KHz to 2 MHz
Min. Pulse Width	1.5 nsec in FWHM
D-T Neutron Yield	about 10^4 n/pulse

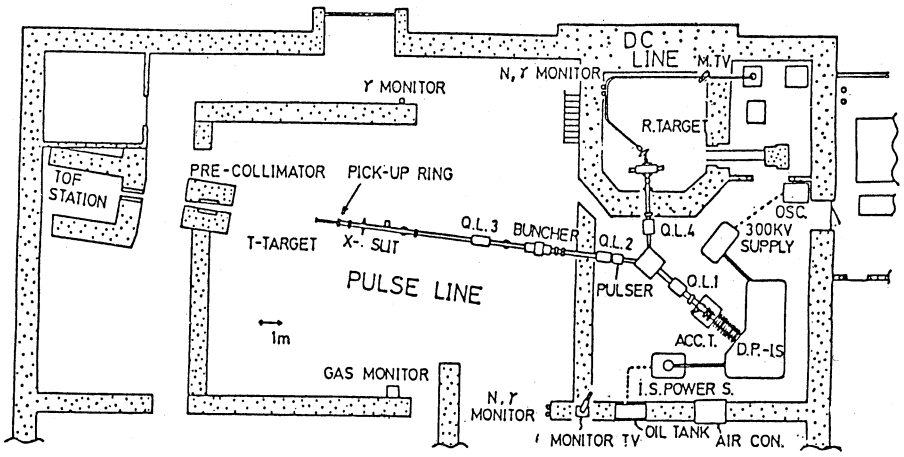

Fig.1 : Layout of OKTAVIAN

Ion beam irradiation is possible with H^+ and He^+ ion beam for the study of damage effects on metal specimens[5].

Figure 2 shows an example of measurement of double differential neutron emission cross sections[2] for natural lithium. Such microscopic measurements are fed back to nucleonic designs of reactors and blanket engineering experiments to be done in OKTAVIAN facility. As basic blanket experiments, measurement of neutron multiplication by lead shell[3], benchmark experiment of D-T neutron shielding for lithium metal, stainless steel, concrete and so on are under way.

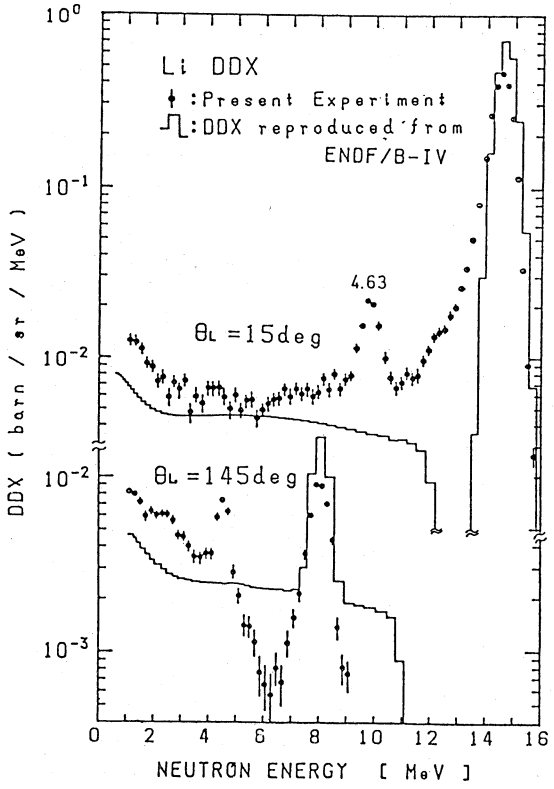

Fig.2 : Double differential cross sections for natural lithium

-References-

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