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Technical Notes

Total Neutron Cross Section of Mylar at Low Energies

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ABSTRACT

The total neutron cross section of Mylar has been measured in the range 0.007 to 20 eV by the time-of-flight transmission method.

The total neutron cross section of Mylar ($C_{10}H_8O_4$) has been measured in the range 0.007 to 20 eV by the time-of-flight transmission method, using a 25 MeV Linac and a fansteel target as a pulsed neutron source. The objective of the measurement was to obtain cross sections which could be used to correct spectral data from time-of-flight systems employing Mylar windows, as is frequently the case. A 20-× 20-× 10-cm block of paraffin thermalized the neutrons and was viewed through an 8-cm-diam collimator leading to a 17-m evacuated flight path. A 12.5-cm-diam by 1.27-cm-thick ^{6}Li glass scintillator coupled to an EMI-9618R photomultiplier tube was employed as the detector at the end of the flight path.

Four Mylar samples with neutron transmissions at ~10 eV ranging from 70 to 90% were used by placement in the middle of the flight path. Sample thicknesses were measured directly and by weighing to an accuracy of 0.5%. Two ^{235}U miniature fission chambers inside cadmium covered paraffin cubes located in the Linac cell monitored the neutron source from one run to another. Time-of-flight data were taken utilizing a 1024-channel (16 μsec each) Laben TV-60 encoder connected "on-line" to an IBM/360 model 44 computer. Backgrounds were measured in separate runs with suitable filters added to the sample location:

1. a filter opaque to thermal neutrons (a 3.5-cm-thick block of paraffin) to measure gamma-ray fluxes from the source
2. a filter opaque to thermal neutrons and source gamma-rays comprising item[1] above plus a 10-cm-thick lead brick.

Raw data were corrected for deadtime, mean emission time and backgrounds. The resulting spectral data were initially grouped into energy intervals of ~5%. Sample transmissions were corrected for in-scattering and multiple scattering. Each set of transmission data was smoothed using a least squares convolution factor method[1] and the statistical error values were then interpolated by Aitken's method to fixed energy values chosen to be 40 points per energy decade at equal lethargy intervals.

TABLE I

Total Neutron Cross Section of Mylar

	Cross Section (b) at Energy:				
E (eV)	E × 10^2	E × 10^1	E × 10^0	E × 10^{-1}	E × 10^{-2}
0.9440		225.9	237.7	330.7	620.1
0.8913		226.0	238.7	337.5	627.2
0.8414		226.2	239.4	344.7	634.4
0.7943		226.3	240.1	352.4	641.8
0.7499		226.5	240.9	360.1	649.6
0.7079		226.8	241.6	367.3	658.5
0.6683		227.1	242.4	374.6	
0.6310		227.4	243.4	382.3	
0.5957		227.7	244.1	389.9	
0.5623		228.0	245.0	397.0	
0.5309		228.3	245.9	404.1	
0.5012		228.7	247.0	411.4	
0.4732		228.9	248.6	419.2	
0.4467		229.0	250.1	427.2	
0.4217		228.9	251.6	435.2	
0.3981		228.9	253.0	443.1	
0.3758		228.8	254.3	450.8	
0.3548		228.8	256.2	458.1	
0.3350		228.7	258.2	465.3	
0.3162		228.8	261.0	473.0	
0.2985		228.9	263.7	480.6	
0.2818		229.0	266.5	488.1	
0.2661		229.2	269.5	495.7	
0.2512		229.4	272.5	503.6	
0.2371		229.5	275.6	511.3	
0.2239		229.7	278.6	519.0	
0.2113	226.1	230.0	281.4	526.6	
0.1995	226.1	230.3	284.1	533.6	
0.1884	225.9	230.6	286.9	540.3	
0.1778	225.7	230.9	289.8	546.7	
0.1679	225.5	231.2	292.8	552.9	
0.1585	225.4	231.6	296.1	559.3	
0.1496	225.6	231.9	299.4	565.5	
0.1413	225.7	232.3	302.3	571.9	
0.1334	225.8	232.8	305.2	578.2	
0.1259	225.8	233.2	307.8	584.7	
0.1189	225.7	233.8	310.9	591.4	
0.1122	225.7	234.6	314.8	598.5	
0.1059	225.8	235.5	319.5	605.7	
0.1000	225.9	236.6	324.8	612.8	

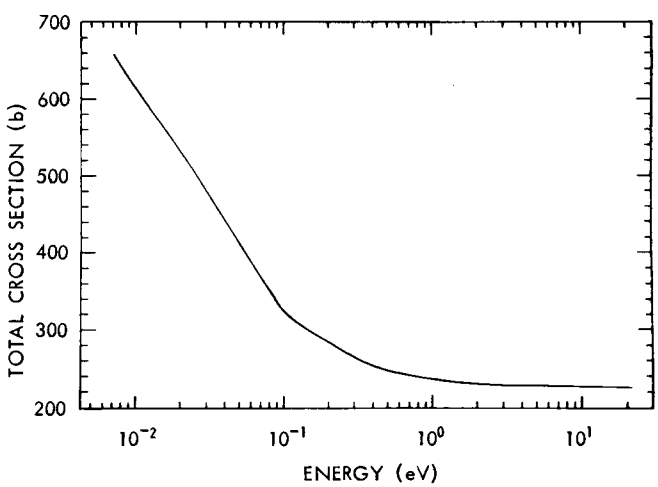

Fig. 1. Total cross section of Mylar.

The resulting data are presented in Table I and shown graphically in Fig. 1. These are a weighted average from 16 runs performed with the 4 samples. The errors are due mainly to inaccuracies in source monitoring and are better than 2%.

The result at 10 eV is in close agreement with the sum of the free atom cross sections 225.1 b.

[1] D. J. GORMAN, "A Computer Program for the Smoothing and Differentiation of Data from Multichannel Analyzers," UCRL-19903, University of California, Berkeley (1970).