ELASTIC AND INELASTIC SCATTERING OF ^{3}He AND ^{4}He IONS WITH 12-20 MEV/NUCLEON ENERGY ON ^{14}N, ^{16}O, ^{20}Ne NUCLEI

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The paper presents experimental differential cross-sections of scattering of ^{3}He and ^{4}He ions with 48 - 60 MeV energy on ^{14}N, ^{16}O, ^{20}Ne nuclei in 10 - 170^{0} angle range in laboratory coordinate system. The investigation has been performed on the U-150M Kazakh isochronous cyclotron.

Measurements were carried out on the studied nuclei at a gas target [1]. Characteristics the target used in the experiment are shown in Table 1.

Table 1 *- Characteristics of the target nuclei*

nucleus	isotope, %	thickness, mg/cm2
^{14}N	99,63	1,37 – 7,66
^{16}O	99,76	1,67 – 9,35
^{20}Ne	90,92	0,96 – 5,36

Registration and identification of elastic and inelastic channels of ^{3}He and ^{4}He were done with the system of multi-dimensional analysis based on (ΔE-E) method where telescope of Si-detectors ΔE with thickness 18-100 μm and E – from 500 μm to 2 mm, spectrometric system of ORTEC and PC.

The analysis of cross-sections of elastically scattered nuclides ^{3}He and ^{4}He on studied nuclei was performed using standard optical model (by code SPI-GENOA [2]) with Woods-Saxon potential with separated form-factors of real and imaginary parts. The optimal values of inter-nuclear interaction potentials are obtained. As a criterion for matching the results of theoretical calculations with experimental data the minimization of the $\chi 2$ values and the values of the volume integrals of the real part of the optical potential were used. The obtained optimal parameters of the interaction potential, the values of the volume integral J_R and χ^2 values are given in Table 2.

Table 2 *- The optical potential parameters of interaction ions ^{3}He and ^{4}He with the investigation nuclei*

nucleus	ions	E (MeV)	V_0 (MeV)	r_o (fm)	a_o (fm)	W_D (MeV)	r_D (fm)	a_D (fm)	J_R	χ^2/N
^{14}N	^{4}He	48,2	117,3	1,24	0,78	9,61	1,57	1,66	396	28,2
^{14}N	^{3}He	60	114,7	1,0	0,82	3,75	2,5	0,69	345	13,7
^{16}O	^{4}He	48,1	130,4	1,17	0,77	16,86	1,3	0,93	366	21,9
^{16}O	^{3}He	60	134,4	1,0	0,91	4,23	2,3	0,53	376	9,6
^{20}Ne	^{4}He	48,8	112,0	1,26	0,81	25,80	1,46	0,84	364	10,4

Analysis of cross sections of inelastic scattered ions of helium was carried out using the

distorted wave Born approximation (by code DWUCK4 [3]) with form-factor of a macroscopic collective excitation using optimal optical potential parameters obtained from elastic scattering.

References

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