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Differential Cross-sections Measurement of the 12C(d, p0)13C Reaction

In this work we present a new and reliable set of differential cross-sections for 12C(d, p0)13C reaction in the energy range of 600 –200 keV at a detection angle of 165°, all in the laboratory reference system.
Several experimental cross-section datasets for the 12C(d, p0)13C (Q=2.73 MeV) reaction have been published at various deuteron beam energies and different angles of detection [1-3]. The observed discrepancies between the existing cross section datasets, especially at resonances, have motivated us to conduct new measurements. All measurements were conducted using the deuteron beam of the 3 MV Van de Graaff electrostatic accelerator of Nuclear Science and Technology Research Institute (NSTRI) in Tehran. The energy of the incident deuteron beam was varied with 30 keV energy steps off-resonance regions and 2 keV steps in the narrow resonance regions. The backscattered protons were collected by an ion implanted Si detector at a scattering angle of 165° with respect to the beam direction.
Two thin-targets, of natural isotopic composition, were used to measure the cross sections in different energy regions: a C/Ag target for the deuteron energy region Ed =1.25-1.5 MeV where the resonances are narrower, and a C3H6N6/Ag target for the rest of the deuteron energies [4].
The present data were compared with the existing experimental data in literature and discussed.
The comparison our data with the evaluated differential cross sections obtained from the online R-matrix calculator SigmaCalc (http://sigmacalc.iate.obninsk.ru) reveals the there is a good agreement in shape and values of both excitation functions. The obtained resonances at Ed = 948, 1190, 1313, 1446 and 1782 keV, are in close agreement with excited states of 14N compound nucleus.
The overall systematic uncertainty of the measured cross section data was estimated to be better than 5%.
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