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Formation of ^{3,4}He in the reaction of stopped pions absorption

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The results of the investigation on spectra and yields of helium isotopes ^{3,4}He formed in the reaction of stopped pion absorption by atomic nuclei are presented.. The work is based on the unique set of data on the charged particles formation on the seventeen target nuclei in the range of mass numbers $6 < A < 209$. The experiment was conducted on the synchrocyclotron at the St. Petersburg Nuclear Physics Institute using a semiconductor spectrometer [1].

In [2, 3] we proposed a phenomenological model that satisfactorily describes the experimental spectra of charged particles (p, d, t, ^{3,4}He) in the reaction. In the present work the contributions of different mechanisms of the helium isotopes formation during pion absorption on medium and heavy nuclei are determined within the framework of the model.

The simulation of the intranuclear cascade processes allowed to determine that the contribution of knock-out process into the formation of ^{3,4}He is ˜ 10% of the total yield. The process of the pick-up of intranuclear deuterons by primary protons contributes about 70% to the formation of ^{3}He. On the basis of the data on the formation of the primary deuterons [3] the contribution of the pick-up process ($d + d \rightarrow {}^{4}$He) in the formation of ^{4}He has been determined. It is shown to be at least 30% of the total yield.

The approach allows to satisfactorily reproduce the spectra of ^{3,4}He at energies > 30 MeV. Analysis of other secondary processes which can lead to the formation of slow ^{3,4}He has been made.

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